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THE PRAIRIE DOG, OWL AND RATTLESNAKE.

BY S. W. WILLISTON.

VERY singular and amusing stories have been, and still are, accepted by many of the amicable relationship existing between the prairie dog, burrowing owl and rattlesnake. It is not within the province of the present article to repeat them, for they are familiar to every school boy. Many of their habits, however, are yet little understood, and I shall endeavor to give the results of several years observation on the plains and in the mountains.

The prairie dog (*Cynomys ludovicianus*) is widely extended through nearly all the Rocky Mountain region of the United States, and seems to thrive equally well in the bleak regions of the Upper Yellowstone, or in the fervid tableau of Central Mexico. In the rich, fertile lands of Central Kansas, they sometimes become disagreeable nuisances to the farmers, making sad havoc among the fields of growing grain. In the dry, scorched deserts of Southern Colorado, I have seen the villages where one would almost suppose the simplest forms of animal life were incapable of being supported. In the cold, bleak Laramie plains, where but little vegetation save the sage brush can exist, and where for more than six months in the year they seldom dare expose themselves to the bitter winds, they thrive in countless numbers. They are, however, provident little fellows, and literally make hay while the sun shines! Late in the summer one will frequently meet burrows, around the entrance of which, for some distance, the grass has been neatly mown, and left to cure. Were he to visit any of them a day or two later, he would find the hay all cleanly removed. In a few instances I have surprised the inhabitants carrying the nicely preserved hay into their dwellings. As their

food consists, almost exclusively, of grass and succulent stems, I doubt not that they thus provide food, as well as bedding, for the sometimes long and rigorous winters they have to endure. But notwithstanding their prudent squirrel-like habits they emerge in the spring much less plump, with the surplus of fat acquired by autumn, well nigh exhausted.

They prefer for their villages, gently sloping lands skirting the valleys, but are often found in the tops of the highest divides, and far down near the streams, though always avoiding rocky, marshy, or even moist grounds. The villages rarely cover many hundreds of acres, and are even miles in circumference, but more usually number from a score, to a hundred or two burrows.

Whole villages will, not infrequently, be deserted, and left to the peaceful possession of the owls and snakes. The cause of such nomadic habits is not clearly seen.

It requires a considerable courage to trace out one of their burrows. They descend obliquely and sinuously to considerable depths, and frequently, if not usually, I believe, have more than one opening. The entrance is always protected by a circular mound, and after a severe rain, or when otherwise damaged, the busy little inhabitants carefully repair it, throwing the dirt up with their hind feet till water is securely guarded against. Their holes are rarely seen in situations where any but the severest freshets would overflow. But once have I known their villages to be extensively inundated, and, as in that instance, the camp was washed away, and all the members of our party given a very cold midnight bath, they were certainly excusable for lack of foresight! The instinct that teaches them of such danger is not strange, when we recollect that animals of lower intelligence, as the brown thrush and wild goose will depart from their usual habits, and build nests beyond reach of the constantly recurring freshets.

During all warm, pleasant days, the villages are scenes of busy activity. Never strolling beyond immediate reach of their retreats, they have few enemies to fear besides the snakes. They are clumsy in movement like a young pup, and, when rarely surprised at a distance from their burrows, may be caught without much difficulty. They are quite social among themselves, and when not engaged in hunting food, make frequent calls upon their neighbors, to discuss, probably, the affairs of their quiet commonwealth.

At the first approach of an intruder, a general scampering takes place throughout the village with warning cries; upon reaching their mounds they sit perfectly erect, like so many sentinels, curious to know the cause of all the commotion. Upon nearer approach they sit more closely in the entrances, and threaten most vehemently, throwing up their tails in a very comical manner with each energetic bark, their noisy chatterings mingled with liquid, gurgling tones. Not infrequently, they will allow one to approach within a rod or two, growing still more vociferous in their scoldings, and occasionally making very amusing little dashes, as if to overawe the intruder. In a twinkling they disappear and continue their gurgling remonstrances a few feet below the entrance. It is very hard to obtain specimens by shooting, for no matter how badly wounded, they elude their would be captor, instinctively—one might say, automatically, for I have seen them escape beyond reach after the rifle had spattered their brains over the mounds! A readier way to obtain them is by inverting a barrel or high box half filled with sand over an entrance. They will find their way to the surface of the sand, but cannot return, and are thus securely caged.

A dog, or other small animal dying in the burrow, is allowed to remain, and it is rare that a mound, not freshly made, will not show skeletons of one or more.

I have noticed the young most frequently in May, less so in August, or early September, in litters of from four to six or seven, playing about the entrances. They are not far behind the adult in their noisy chatter, but less timorous, remaining last on the surface, and responding to the parents' gurgling below, as if much the wiser.

The prairie dog readily becomes accustomed to the haunts of man, their villages sometimes being scattered through the outskirts of thriving towns. Though easily tamed to feed from one's hand, they resent caresses, enforcing their scoldings with ready use of their sharp incisors. In a little town in Western Kansas, a pair of tame ones after frequent changes, took up their abode in a large, open lot, where they were very noisy in their protestation against intrusion, especially of the school children and dogs. A young lady teacher in passing by, incurred their highest resentment. They would follow her closely, often to the school house door, a distance of several hundred yards, chattering noisily, and

making furious angry dashes at her, till she was compelled to choose another path. In three years they had propagated to a very considerable little colony with several dozen burrows.

I have seen it stated that the prairie dog finds an enemy in the skunk. I can hardly credit it. The skunks of the plains frequent the low marshy lands near streams and ponds, raising their young near the water's edge; and not usually approaching the vicinity of the prairie dog villages; their food consisting mostly of insects, snails, crayfish, etc. Prof. Snow observed them feeding largely upon *Amblychila cylindriformis.*

It is a prevalent belief in the west, and has so been published, that these animals dig wells for their water! I have never yet learned of an authenticated instance, and in many cases the idea is absurd. Their villages are often in high localities, several feet above water, and much of the distance through loose impervious sand or rock strata! It is true that in captivity they readily and frequently drink, but this is also the case with the little striped squirrel (*Spermophilus*), and that the latter also dig wells is too great a tax upon credulity. They do not obtain water from the surface even when within convenient distance.

The prairie dog and burrowing owl (*Speotyto* var. *hypogæa*) will, not infrequently, occupy the same hole, but the latter, like the other parasites, is there on sufferance, to whose presence the dog pays but little heed, though probably one of the causes of the abandonment of the villages. Not long since I was greatly amused while passing a mound upon which an owl was quietly engaged in contemplation, at the attempts of a squirrel to pass by into his hole. If any of my readers have ever observed a puppy attempting to purloin the treasures of a sitting hen, they will have a very good idea of the action and appearance of both owl and dog—the owl very indignant and the dog very sheepish. After numerous ignominious retreats, however, he finally ran the gauntlet successfully, but not without several most vicious peckings.

There are but few birds that present a more ridiculous appearance than these owls. Most of the time during the day they spend standing quietly at the entrance of their dwellings, engaged, apparently in the deepest contemplation. At the appearance of an intruder they begin the most comical bowings and courtesies, all the while staring with their solemn eyes till with a cry not

unlike a watchman's rattle, nor less melodious, they fly to a neighboring mound and resume their pensive meditation. At nightfall they fly about in search of food, and through many months have I listened to their monotonous tones blending with the similar notes of the raincrow and the startling cry of the cayote, upon the stillness of the western plains. By far the most frequently, the owl is found in the deserted villages of the prairie dogs, in communities by themselves. The young or half grown I have only noticed in the latter part of July and August.

The relations of the rattlesnake with both squirrel and owl, although not at all friendly, is scarcely so inimical as one might suppose. Of the species most peculiar to the prairie dog regions (*Crotalus confluentus*), I have destroyed many hundreds, and although in numerous instances the stomach would show the young of the prairie dog, yet I was never positive in finding the young owl. In one instance I found the adult dog poisoned by the rattlesnake, and twice have caught the half grown as they were driven out by the venomed blow. In these instances the cry of pain and fear was almost incessant, and peculiar; the little victims succumbed in three or four minutes to the fatal poison. For a long time I believed that the occupancy of a burrow by a snake would prevent the ingress of the dog, but I am now satisfied that such is not the case. The rattlesnake is never wanton, it simply defends itself from danger or annoyance, or procures its food by means of its terrible fangs. Small animals or other reptiles do not generally show much fear, or at least soon recover composure when thrown together with them; least of all will they bite other snakes. It is not very uncommon to meet on warm days in spring or autumn, rattlesnakes and racers (*Bascanion flaviventris*) sunning themselves entwined together near the entrance of some favorable hole. The prairie dog will pass by them and enter its burrow. Both of these snakes choose any convenient shelter for the time being, neither molested nor particularly avoided by the prairie dog and owl. When fortune favors them they readily devour the young squirrel, and more than one at a meal; but their more usual food is the ground-nesting birds, rats, mice, ground squirrels, etc. In one moderate sized rattlesnake, whose stomach I examined, were found a freshly killed ground squirrel, and slum lark, together with a half digested lark finch (*Chondestes grammaca*).

The rattlesnake is slow and sluggish in his movements, and prefers shelter in damp or cold weather. When intent upon prey he is less readily induced to rattle, but at other times his stroke is usually preceded by a warning. When mating during May they are more vicious than at other times. The danger from the rattlesnake's bite has been popularly over-estimated. I have observed a great many cases among the larger animals; fatal results have been the marked exception. Among horses and cattle not one case directly fatal has come within my notice.

In man, in eleven cases there were three deaths, two of which were most probably through ignorance or improper attention.

The rattlesnake is not dependent upon vision alone in detecting danger; his warning rattle may often be heard while yet he is entirely concealed, having been apprised of intrusion either by the sense of hearing or by mere tractile vibration.

In addition to the owl and the snake, there are still other dwellers in the burrows of the prairie dogs, but they are very useful little scavengers, though only beetles. Six or seven species of *Eleodes* and *Asida* are always found near the burrows, and one or two are almost peculiar to them.

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RAMBLES OF A BOTANIST IN NEW MEXICO.

BY EDWARD LEE GREENE.

II.

THE neighborhood of the old copper mines furnishes the best of ground for studying the imperfectly known and therefore very interesting sylva of the remote south-west. The number of species belonging to genera which make up forests in other countries is very considerable, and yet there is nothing in all this region which merits the name of a forest; nothing which an emigrant from "the States" would call "a piece of good timber." Of oaks, for example, there are four species, but one of which attains the dimensions of a middle-sized forest tree; this is Gambel's oak (*Quercus gambelii* Nutt.), a deciduous tree with something of the habit of the Wisconsin burr oak, but having foliage and acorns more like those of the common white oak. It grows rather sparingly in the little valleys among the higher hills, and is about the only oak of the region whose wood is good for any-

thing but fuel. Another kind of white oak common on all the hill-sides near the plains is of a low but stout habit, showing a trunk a foot or two thick but rarely attaining a height of twenty feet. Its leaves are oblong in outline, small and of a rather leathery texture, not deciduous, but remaining on the tree until the appearing of the new ones in April. Emory's oak (*Q. emoryi* Torr.) is a small but rather handsome tree. It has hitherto been erroneously classed with the white oaks, owing to the insufficient material brought in by the various explorers who had seen it; but it rarely takes rank among the blackest of the black oaks. Its bright-shining lance-shaped leaves remain green all winter, falling, like those of the species mentioned above, only when the new ones are appearing in spring. The fourth species of the genus, found away upon the summits of the Santa Ritas (*Q. hypoleuca* Engelm.), though a mere bush is very unique and pretty, with narrow laurel-like leaves which are dark and shining above, and on the under surface beautifully clothed with a fine dense-white wool. The bush is perfectly evergreen. The black walnut of the region (*Juglans rupestris* Engelm.) is a small species with nuts differing from those of its eastern congener, though the wood is quite similar; but lumbermen rarely find a trunk of this walnut large enough to be sawn into boards. The pines, with the exception of the tall yellow pine (*P. ponderosa* Dougl.) which occurs rather sparingly on the more elevated mountains, are of the dwarf nut-bearing sorts (*Pinus edulis* Engelm., and *P. chihuahua* Engelm.) called piñon by the Mexicans, of little value except for their oily and nutritious nut-like seeds. The very graceful willow-leaved cottonwood (*Populus augustifolia* James) frequents the banks of streams, makes a beautiful shade tree, is largely employed for that purpose on the streets of the young New Mexican towns, but is not otherwise very valuable. And here where oaks, pines and walnuts, the *large* trees of other countries, appear only in the shape of dwarfs, the junipers, which in other regions are usually small, develop into trees of very respectable size. It seems a favorite soil for junipers, for we meet here the leading species of the east (*J. virginiana* L.) and its ally of the Pacific coast (*J. occidentalis* Hook.), besides a fine species peculiar to the interior south-west, which is remarkably different from both (*J. pachyphlœa* Torr.). This is an oddity among junipers by having instead of the dark red very fibrous bark common to most

of them, a trunk so clothed in light ash-gray that at a little distance it looks almost precisely like the trunk of a white oak. Mexicans, much averse to the hard work of swinging an axe, never undertake the operation of cutting down even a medium sized tree of any sort; they prefer, when wood is wanted, to climb the trunk and cut off the branches; thus in the vicinity of any Mexican village among these hills, one sees instead of low stumps, trunks standing ten or fifteen feet high simply divested of their arms or branches. Where white oaks and this juniper had grown side by side it was hardly possible to distinguish between them in the absence of the branches so closely does the one imitate the other as to the appearance of the bark. I took the measurement of a vigorously growing not old-looking specimen of *Juniperus pachyphlœa* and found the circumference of its trunk, at three feet from the ground, fifteen feet and three inches. The height of the tree was a little more than forty feet. The berries of this tree are light-green with a blue bloom when mature, and are full four times the size of ordinary juniper berries. They are sweet and not unpleasant to the taste, and as an article of food seem to be greatly enjoyed by various birds and mammals, and by the Indians. Among the small trees of the region the mountain mahogany (*Cercocarpus parvifolius* Nutt.) is valuable on account of its very hard wood, for nearly all the rest of the native woods, even that of oaks, is light and brittle. The New Mexican locust (*Robinia neomexicana* Gray) is another small tree, or sometimes a mere shrub, remarkable not from any utilitarian point of view but for its great beauty when loaded with its heavy pendant racemes of rose-purple flowers. No other North American locust is so highly ornamental. But perhaps the most beautiful flowering tree of this section and of the whole south-western country is the one known to the Americans by the common name of desert willow (*Chilopsis linearis* DC.). The appellation sounds paradoxical surely, for from the ancient Hebrew poets down to the present generation, all, even superficial observers, know that the place for willows is not in deserts, but "by the water courses." And the tree in question is not indeed a willow, though the Mexicans have made the same mistake as we, for they call it the *mimbre*, which is the Spanish word for osier. But with its black bark, like that of some species of willow, and its long narrow leaves clothing slender and gracefully-

drooping boughs, it is well enough named desert willow, though it belongs technically to a very different order of trees. The catalpa of the south-east is its nearest ally. The flowers of the two trees are much alike in form and size, but those of Chilopsis are bright deep pink color with purple markings; and clustered among the willow-like foliage on branches that droop and sway with every breeze, they place the species far superior to the catalpa in point of grace and beauty. We hardly meet with it in our mountain saunterings, nor even along the banks of the Rio Mimbres, which pretty stream, flowing along the eastern base of the Santa Ritas, takes its Spanish name from the real willows which overshadow its clear and rippling waters. Only beyond the mountains on the sandy plains, though indeed in the lowest parts of them, along channeled sands where water sometimes flows after a heavy shower, do we find the shade of the branches and inhale the pleasant fragrance of the flowers of the desert willow. One cactus of the plains, which attains the dimensions of a small tree (*Opuntia arborescens* Engelm.), maintains a foothold among the rocks in the cooler, fresher region of the mountains, and in spite of its defiant aspect, armed thickly as it is with stout needle-pointed spines, it is a splendid object late in June when every branch bears at its apex a cluster of very large brilliant magenta blossoms. Another of a different genus (*Cereus fendleri* Engelm.), is a humbler tenant of the rocks, with still more beautiful flowers. Of the two species of Yucca noticed, one (*Yucca angustifolia* Pursh) merits the name of a true lily, growing as it does to the height of twelve or fifteen feet, the large panicles of nodding white lily-like flowers sometimes of themselves measuring six feet long. It is a majestic plant when in bloom, though less to be admired at other seasons, when it displays a mere branchless trunk terminating in a single tuft of long narrow leaves. In this last-named condition a group of yuccas seen at a distance on the plains has a singular likeness of a band of long-haired south-western savages, and has often been at first sight mistaken for such by travelers newly coming into these sub-tropical regions. The other member of this genus (*Y. baccata* Torr.) is of humbler growth, and its flowers are succeeded by edible fruits looking a little like bananas and having the flavor of pawpaws, together with slightly cathartic properties.

I read one day in an eastern newspaper a notice that a century

plant was about to flower in some one's conservatory in an eastern city. The plant is well known to be a native of old Mexico. I had seen many forms of it growing along the Rio Gila in Arizona, where it constitutes, together with stately yuccas and giant cacti, a marked feature of the landscape. Here, near Santa Rita del Cobre, I had in my rambles come upon several localities where a fine large form of it was abundant. In May I had observed the starting up of the flower stalks from the centres of such as were to flower this year. Now, near the end of June, I set forth one morning in the direction of the nearest locality of the plant which I had remembered, expecting to see them in bloom. My anticipations were realized after an hour's ride. On coming within sight of the mountain side where they grow, the great branching stems were visible, each branch terminating in an umbel of greenish yellow. I rode up to the nearest specimen, but was unable to reach, from the saddle, the lowest branch of the gigantic panicle. In the act of tying my horse to another of them I was surprised by the fall of an abundant shower of honey. Every one of the great mass of tubular flowers was filled with a clear, rather fetid liquid, very sweet, however, to the taste; and a jarring of the great stalk was sufficient to bring down mellifluous rain more copious than agreeable. This New Mexican species is not identical with the century plant common in cultivation, but is probably new and undescribed. During the weeks of my delightful sojourning in the Santa Ritas my favorite rambles were along the streamlets that come, I had almost said running, but rather dripping, down from among the higher peaks and ridges. The smaller of these are commonly lost among the rocks midway between their sources and the plains below; and the best of them sink into the thirsty ground as soon as they get fairly down out of the mountains. Nothing less than a great river could preserve itself and get across those sun-burnt, rainless tracts that separate the different mountain districts of the southwest. It was charming however, when among the hills, to go up several miles of some ravine where a scanty rill came trickling down. On one side, that which sloped northward, one could proceed under the shade of pines, oaks and cedars and salvias blue or scarlet-flowered, purple clematis climbing up among wild cherry bushes, and other delicate shade-loving plants peculiar to the region. On the opposite side where the slope was to the

hot sunny southward, one saw no trees, nor plants of fine or graceful habit, but only yuccas, century plants, cactus and Dasylirion, adorning with rigid and stately magnificence the otherwise almost barren rocks. On less rugged portions of these hot unshaded hills is where we look for and find various species of an interesting genus (*Dalea*) of peculiar south-western leguminous plants. Some are herbs, others shrubs, with small, *very* small ferny foliage and a profusion of yellow pink or purple corollas set usually in exquisite white-feathery calyces. Another characteristic and very abundant shrub of these ravines and hill sides is an oddity of the rose family (*Fallugia paradoxa* Torr.), in which the flower of a rose, or it might rather be called that of some large flowered raspberry, or blackberry (*Rubus*), is succeeded not by a berry of any description, but by a close tuft of dry seeds with long silky tails, much like those of a clematis, but finer and more graceful, and of a purplish hue. They are borne in great profusion and the bush is more showy in seed than in flower. But passing upward beyond where all these interesting things are found, we come to higher, more open and smoother lands at an altitude where snows are more sure to fall in winter, and showers in summer are more frequent. Here are scattered pines of larger growth, and under them grasses are abundant and the wild deer graze in safety; masses of blue lupines, with here and there a tall stalk of flame-red pentstemon (*P. barbatus* Torr.), occupy the more open grounds, while, farther upward still, the ravine narrows to a gorge a few rods wide. Here we find our streamlet a brook shaded by alders and poplars, and the dripping precipices are clad with mosses, mimuli and saxifrage, reminding the herbalist here upon the borders of Mexico of familiar scenes in far northward latitudes.

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ON THE TRANSFORMATIONS AND HABITS OF THE BLISTER-BEETLES.[1]

BY CHAS. V. RILEY, A.M., PH.D.

THE larval habits of the European Cantharis of commerce, as also those of its congeners in our own country and in other parts of the world, have hitherto remained a mystery, notwithstanding the frequency with which the beetles occur, their great

[1] Adapted by permission from the Transactions of the Academy of Science of St. Louis.

abundance at times, and their commercial value and interest. The same remarks hold true of the allied genera *Macrobasis*, *Epicauta* and *Henous*, the species of which have the same valuable vesicatory properties as *Cantharis*. Some of these species are very common in the United States, and quite injurious to vegetation, swarming at times on potato vines, beans, clematis, and other plants. Their great numbers and destructive habits make it all the more remarkable that so little has hitherto been discovered of their early life. Harris, who evidently had hatched the first larva of the Ash-gray Blister-beetle (*Macrobasis unicolor* Kirby), says: "The larvæ are slender, somewhat flattened grubs, of a yellowish color, banded with black, with a small reddish head, and six legs. These grubs are very active in their motions, and appear to live upon fine roots in the ground; but I have not been able to keep them till they arrived at maturity, and therefore know nothing further of their history." (*Ins. inj. to Vegetation*, p. 138.) Latreille, according to Westwood, states that the larvæ live beneath the ground, feeding on the roots of vegetables (*Intr.*, vol. i., p. 301), but the statement is evidently founded on conjecture. Ratzeburg, who well describes the method of oviposition of the European *Cantharis vesicatoria*, and roughly figures the first larva (*Forst Insecten*, II, Col. Taff. ii, fig. 27 *B*), believed that it was a plant-feeder in the immature state. Olivier describes what is possibly the second larva as a soft, yellowish-white, 13-jointed grub, with short filiform antennæ, and short, corneous, thoracic legs—"living in earth" (*Traité Elém.*, etc., M. Girard, Col., p. 618); but his account is very loose, and may apply to any number of other coleopterous larvæ. Audouin, who studied the Cantharides intently, making them the subject of his thesis in his medical examination, was obliged to confess that absolutely nothing was known of their larval history. This is about all we learn from the older authors, and more recent writers have shed no further light upon the subject; Mr. Wm. Saunders, of London, Ont., in a paper on these insects, read at the 1876 meeting of the American Pharmaceutical Society, being unable to add anything more definite. Among the early writers the opinion was general that the Blister-beetle larvæ in question were vegetable feeders, like their parents. In 1874 Laboulbène mentioned the fact (*Ann. Soc. Ent. de France*, 1874, lxxxiii) that some one (name not given) had seen the European *Cantharis vesicatoria*

issuing from the ground in the neighborhood of which there were wasps (*guêpes*—no specific reference given), and rashly concludes that the former were parasitic on these. Still more recently M. J. Lichtenstein, of Montpellier, France, has endeavored to discover the larval habits of this species, and gives some reasons for believing that it develops in the nests of *Halictus*.[1]

These facts, as well as analogy, pointed to a parasitic life and partly carnivorous, partly mellivorous diet for our own allied species, since the life-history of two genera in the family, viz: *Meloë* Linn. and *Sitaris* Latr., has been fully traced. Indeed, the young of all vesicants belonging to the *Meloidæ*, so far as anything has yet been known of them, develop in the cells of honey-making bees, first devouring the egg of the bee and then appropriating the honey and bee-bread stored up by the same. They all are remarkable, in individual development, for passing through seven distinct stages, viz: the egg, the first larva or *triungulin*, the second larva, the coarctate larva or pseudo-pupa, the third larva, the true pupa, and the imago. They are further remarkable in that the first pair of spiracles are distinctly mesothoracic and dorsal in the triungulin.

History of Meloë.—The history of *Meloë* may be briefly summed up as follows: The newly hatched or first larva (now generally called *triungulin*) was first mentioned in 1700 by the Holland entomologist Gœdart, who hatched it from the egg. Frisch and Réaumur both mistook it for a louse peculiar to bees and flies. De Geer, who also obtained it from the egg, mentions it in 1775 as a parasite of Hymenoptera. Linnæus called what is evidently the same thing, *Pediculus apis;* Kirby, in 1802, described it as *Pediculus melittæ*, and Dufour, in 1828, named it *Triungulinus andrenetarum*. Newport, in 1845 (*Trans. Linn. Soc.*, vol. xx, p. 297), first rightly concluded that it was carried into the nests of bees, and described, in addition, the full-grown larva from exuvial characters, and the coarctate larva and pupa which he found in

[1] Quite recently (*Comptes Rendus de l'Ac. des. Sc.*, Paris, Oct. 11, 1877, p. 628) he has succeeded, by furnishing the larvæ of *C. vesicatoria* with artificial nourishment composed of the filled stomachs of honey-making bees, and especially of *Ceratina*, in tracing the development from the triungulin to the coarctate larva, which last differs from those of the other species considered by me, in freeing itself entirely from the second larval skin. He has thus established the fact that *Cantharis* agrees with the other species of the family in its hypermetamorphosis; but its natural habits remain as much as ever a mystery.

the cells of *Anthophora retusa*. He failed, however, to fill the gap between the first and full-grown larva; and this Fabre first inferentially did in 1858 (*Ann. d. Sc. Nat.*, Zoöl. t. ix, p. 265) by tracing the analogous stages of *Sitaris*.

The female *Meloë* is very prolific. She lays at three or four different intervals, in loose irregular masses in the ground, and may produce from three to four thousand eggs. These are soft, whitish, cylindrical, and rounded at each end. They give birth to the triungulins, which, a few days after hatching—the number depending on the temperature—run actively about and climb on to Composite, Ranunculaceous and other flowers, from which they attach themselves to bees and flies that visit the flowers. Fastening alike to many hairy Diptera and to Hymenoptera which can be of little or no service to them, many are doomed to perish, and only the few fortunate ones are carried to the proper cells of some *Anthophora*. Once in the cell, the triungulin falls upon the bee egg, which it soon exhausts. A molt then takes place and the second larva is produced. Clumsy and with locomotive power reduced to a minimum, this second larva devours the thickened honey stored up for the bee larva. It then changes to the pseudo-pupa with the skin of the second larva only partially shed; then to a third larva within the partially rent pseudo-pupal skin, and finally to the true pupa and imago. These different changes of form are known by the name of hypermetamorphoses, the term first given them by Fabre to distinguish them from the normal changes from larva to pupa and imago, experienced by insects generally. The triungulin or first larva (Fig. 1, *a*) is characterized by a prominent labrum, very stout thighs, unarmed shanks, three broad and subspatulate tarsal claws, feeble and reduced trophi, untoothed jaws, 3-jointed antennæ, ending in a long seta, and four anal setæ, the two inner ones longest. When

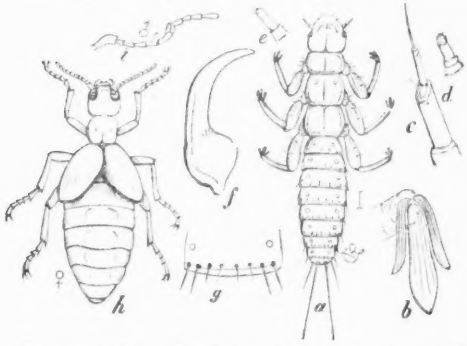

Fig. 1.—*Meloë*: *a*, first larva; *b*, claws; *c*, antenna; *d*, maxillary palpus; *e*, labial palpus; *f*, mandible; *g*, an abdominal joint; *h*, imago ♀; *i*, antenna of ♂.

the abdomen is shrunken the general aspect is very much that of *Pediculus*, and it is hardly surprising that some of the early describers so determined it.

History of Sitaris.—The history of *Sitaris* is also well known and agrees very closely with that of *Meloë*. Its first larva was figured many years ago by Westwood (*Introduction*, etc., fig. 34, 5) from specimens obtained from Audouin, who found the female *Sitaris* in the cells of *Anthophora* enclosed in its thin pseudo-pupal and second larval skins, which Audouin erroneously took to be the pellicle of the devoured bee-larva. But the complete life-history of the genus was first given by Fabre in 1857 (*Ann. d. Sc. Nat.*, Zoöl., t. vii. p. 299; t. ix. p. 265), who studied the *S. humeralis* Fabr., while that of *S. colletis* V.-M. has been more recently given by M. Valery-Mayet, of Montpellier, France (*Ann. Soc. Ent. de Fr.* 1875, p. 65), from whom I have specimens in all stages. The former species infests the nests of *Anthophora*, the latter those of *Colletes*. In the former the newly hatched larvæ hybernate in huddled masses in the galleries of the bee; in the latter they hybernate in the bee-cell, slowly feeding while the temperature permits; but such differences doubtless depend on the relative earliness in the autumn that the eggs are laid. The first larva or triunguiin (Fig. 2, *a*) agrees very much in the head, tarsal and general characters with that of *Meloë*, but differs in several important particulars, and especially in having a pair of pre-anal spinnerets, from which is secreted a serous, sticky fluid, which aids the animal in holding firmly to the bee that is to carry it into the nest. A pre-anal pair of claspers also assist in this work. The hypermetamorphoses are very similar to those of *Meloë*. The triungulin after absorbing the contents of the bee egg, molts, and thereafter floats upon and devours the honey—the pseudo-pupa, third larva and true pupa all forming in due time within the second larval skin. The female does not feed, and on account of her heavy

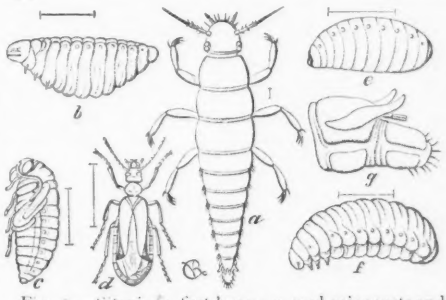

Fig. 2.—*Sitaris*: *a*, first larva; *g*, anal spinnerets and clasps of same; *b*, second larva; *c*, pseudo-pupa; *f*, third larva; *e*, pupa; *d*, imago ♀ (after V.-Mayet).

abdomen travels but a short distance from the bee-burrows where she developed.

History of Hornia.—While the natural history of none of our N. A. species of *Meloë* has been traced or recorded, they will, beyond all doubt, be found to agree with their European congeners in their partial parasitism on Mason-bees. In examining the cells of *Anthophora sponsa* Smith, I have thus far failed to discover that *Meloë* is parasitic upon that species, but *Meloë* is in reality very rare around St. Louis. I have, however, found on four different occasions in the Fall, within the sealed cells of the bee mentioned, a very interesting and anomalous Meloid (*Hornia minutipennis* Riley), which may be taken to represent the typical partial parasitism of the family in the United States. There is a tendency in the family to wing reduction, but in no hitherto described species is the reduction carried to such extremes as in this (Plate 1, fig. 13) both sexes having the elytra as rudimentary as in the ♀ of the well-known European Glow-worm (*Lampyris noctiluca*). Another characteristic feature is its simple tarsal claws, which, together with the rudimentary wings and the heavy body, show it to be a degradational form. *Anthophora sponsa*, its host, builds mostly in steeply-inclined or perpendicular clay banks, and, in addition, extends a tube of clay from the entrance. The burrow of this bee has usually two branches which decline about an inch from the surface of the bank, and six or eight cells are arranged end to end. By means of saliva the inside of the cell is rendered impervious to the moisture of the honey and bee-bread stored in it for the young. It is evident that this clumsy Meloid will have difficulty in crawling out of or about the cells, and it is probably subterranean and seldom, if ever, leaves the bee gallery. The male can climb and drag his body, but with some difficulty, up a steep surface if rough, and, as he does not leave the bee-cell till spring, when the *Anthophora* tubes are very generally broken and have fallen, he may possibly wander a short distance from the mouth of the bee-burrow; but the female will naturally possess less power of locomotion. The triungulin is yet unknown, but the ultimate stage of the second larva as well as the coarctate larva, as shown by the distended and unruptured skins, exhibit the ordinary family characteristics, the legs and mouth-parts being atrophied in the former, and merely tuberculous in the latter. The lateral ridge, as found in

Epicauta and *Meloë*, is not conspicuous, and in this respect, as well as in the final transformations taking place within the two unrent skins, the insect approaches *Sitaris*. In the hairless and unarmed surface of the second larva, and of the third larva and pupa, as shown by careful examination of their shrunken exuviæ, the insect also resembles that genus.

[*To be continued in May Number.*]

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THE PREPARATION OF ROCKS AND FOSSILS FOR MICROSCOPICAL EXAMINATION.

BY R. FRITZ-GAERTNER, PH.D.

IT is often supposed by those who have never prepared sections of rocks or fossils that the process is associated with great difficulties and expenditure of time, but this in reality is not the case. A small amount of practice is needed for the beginner and he may soon be able to manufacture sections which are fit for the microscope. The time spent in the mechanical operation of grinding rocks is not only remunerated by interesting and instructive preparations, but adds also to a complete knowledge of their physical structure, gained by a close observation of the various features they present during the process of preparation.

In cases where large numbers of sections are to be prepared it is not possible for the lithologist or palæontologist for want of time to perform all the work himself: he may be assisted by any person of ordinary ability in the preliminary part of preparation. Those who do not personally wish to prepare sections can be referred to Mr. Fues, of Berlin, or to Mr. A. Julien, School of Mines, New York city, who prepare and deal in sections, which, on account of their perfection, deserve commendation.

In the present article I wish to describe the process of preparing rocks or fossils for microscopical study. They are mainly intended for those who design to make sections themselves, and to whom a detailed description of a mechanical operation may be of some assistance in their first attempts.

Selection of Rock Material.—It is quite important in order to make a complete microlithological analysis of rocks to select material which is characteristic. Most rocks are in various states

of alteration; it is therefore necessary to choose fragments both from the fresh and decomposed parts, as thin sections of the latter ones are just as important and instructive as those taken from parts in which no visible change has occurred. Usually such decomposed rocks are very fragile and crumbling, because their crystalline structure or their cementing medium has been destroyed by the process of decomposition. Before undertaking to grind them their firmness must be restored. The fragments of such decomposed rocks are at first well dried and then placed in liquid Canada balsam, which is exposed on an iron plate to a gentle heat till it has filled and penetrated the pores and fissures of the rock. They are then separated from the Canada balsam and laid upon the warm iron plate till the balsam proves to be hard when cooled down, and are then capable of undergoing the process of slicing or grinding.

Apparatus.—It consists in its most simple form of some plates of iron and glass about eighteen inches square, to allow a full stroke with the arm during the grinding process. They have to be perfectly even and flat. Emery of various degrees of fineness is required to be used on the plates with an addition of water. Fragments of rocks are ground by hand and treated as will be described in the following lines:

In the New York State Museum of Natural History at Albany, where a large number of rocks and fossils have to be cut and prepared for thin sections for illustrating the Palæontology of New York, the slow process of grinding by hand had to be abandoned, and a small boiler and steam engine of two and a-half horse power were purchased for the purpose of using steam-power for the grinding and slicing operations. The grinding apparatus is formed by two circular iron plates (A and B) of eighteen inches diameter and one-half inch thickness, which rotate horizontally with a velocity of about 300 revolutions a minute. The slicer which is used to cut the rock in certain directions, or to separate from it small slices to be ground afterwards, is a thin copper or steel disk of twelve inches diameter, and turns also horizontally with the same velocity as the grinding plates. For rocks above hardness 5, another slicer of steel is used, which turns vertically, and which is fed with diamond powder moistened with oil.

The whole apparatus may be run at the same time, and is

arranged in such a manner that no one operation interferes with another.

The grinding and slicing is performed by the aid of emery, which is constantly applied to the plates and slicer with a brush held in the left hand. The plates are kept wet by a small current of water. It is important to use emery of different but uniform degrees of fineness as the work progresses. A mistake usually made by beginners is to choose a too coarse emery, in order to hasten the work of grinding, but they soon discover that all their sections break and wear off long before being half finished. It is advisable to use for the coarse grinding on plate A an emery which can be bought in any drug store as emery No. 90 (A). Plate B is charged with flour of emery (B); it serves also to prepare one or two sorts of finer emery from it, by treating a certain quantity of the flour with water in a vessel which may be about three feet high and six inches in diameter. In stirring the water, the emery becomes suspended in it; after a lapse of fifteen minutes the water with emery which has not settled down during this time is decanted in a similar vessel and left there for twenty minutes more, when the water may be drained off. A sediment of fine emery will thus form in the latter vessel; and after having repeated the process for some time the emery sediment (emery C) is taken from the vessel, dried and bottled. Its degree of fineness is expressed by the number of minutes, which is in this case fifteen minutes.

Canada balsam serves as a cementing medium, it also is used to increase the transparency of various sections. It should be entirely clear and not of yellowish tint. Usually a solution of Canada balsam in turpentine is employed to mount such rocks as will not undergo any change in heating them gently over a warm plate of iron. For rocks which cannot be exposed to any heat, a solution of pure Canada balsam in chloroform is used. Both solutions of Canada balsam should be well bottled to prevent evaporation.

Object Glasses.—The slides of glass which are intended to bear the section should be entirely clear, free of any color, air bubbles or any other enclosures, as those which are used in other branches of microscopy. Their size should be uniform. Prof. Zirkel, of Leipzig, the distinguished lithologist, has proposed and introduced the following size, 45 *mm. by* 25 *mm.*, which is preferable to the

ordinary 3 *by* 1 *inch*, as a slide 45 *mm.* by 25 *mm.* can be rotated on the table of the microscope; besides they are less liable to break in dropping them, and also take up less room.

In the New York State Museum of Natural History the slide measuring 45 *mm.* by 25 *mm.* is adopted. As it was found that this glass slide was too small for a number of sections of fossils, which exceed the usual size, two other standard sizes were introduced which are in proportion to the first. Size B is twice the size of first = 50 *mm. by* 45 *mm.* Size C is twice the size of second — 50 *mm. by* 90 *mm.* It would be of great advantage if a uniform size was introduced in the various collections of those who prepare sections. The slide 45 *mm. by* 25 *mm.* is generally adopted with lithologists and palæontologists both in America and Europe.

Process of Slicing and Grinding.—The fossil or rock is at first marked with a pencil and afterwards with a file in the direction in which it is designed to be cut. It is then held with the right hand without any further apparatus, in such a direction that the revolving slicer will cut the specimen according to the marked line. The slicer is constantly supplied during the operation with flour of emery and water. If there is plenty of material and no special direction needed, small slices can be separated from the rock by a heavy blow with a hammer. The rock fragments should as a rule not be beyond the size of a twenty-five cent piece; of course it is of great advantage to prepare sections which offer a large field for observation, and the rock specimens should not be chosen too small, as they lose in size during the grinding process.

The slice of rock which has been separated either by the slicer or by the heavy blow with a hammer, is gently pressed with the right hand against the turning plate A, while the left hand supplies plate A with emery A and water. It is necessary to change constantly the position of the rock-slice in the right hand in order to grind it to an even and plain surface. The slice is then well rinsed and cleaned of any particle of emery A, and then transferred to plate B (emery B) where the grinding proceeds till its surface is free of any scratches. Being cleaned of the emery B, it is brought upon glass plate C (emery C) and ground till its surface is entirely smooth. The rock section is finally well rinsed and brushed to clean off all impurities and allowed to dry.

Mounting Process.—A slab of iron two and a half feet long, four inches broad and half an inch thick is laid horizontally upon a tripod (of iron) and heated with a Bunsen burner. The glass slide on which the rock fragment is to be mounted is well cleaned and laid upon a part of the slab which is of a constant and moderate heat; after being warmed a few drops of Canada balsam are placed upon the glass and left with it on the slab till the balsam by evaporation has assumed a tenacious condition, in which its films will not adhere much to the fingers and yet be pliable enough to be bent readily without breaking. The warmed mineral slice is now laid upon the Canada balsam with its ground face down, and allowed to remain on the slab till all air bubbles have disappeared below the slide in the balsam. It is then gently pressed on the glass and then taken off and allowed to cool. It is of great importance to use Canada balsam in its above described condition, as the rock section during the process of grinding thin unavoidably breaks to pieces in case the balsam proves to be too soft, and if on the contrary it has been too long exposed on the slab it will become brittle and the section will, during the grinding, be liable to break off. The loosened mineral slice must in such a case be laid into a dish with turpentine to dissolve the balsam, and after being well cleaned is mounted again as described. There is no considerable difference in the process of mounting with balsam in solution with chloroform or with turpentine. The balsam in chloroform is allowed to harden in a warm room: it usually needs one or two days, while the solution in turpentine by application of heat hardens in from five to ten minutes. In the latter case care should be taken not to heat the balsam too quickly, as it turns yellowish on account of a partial carbonizing.

Grinding Operation.—After having used all necessary precaution in cementing the rock fragments to the glass, the grinding manipulation now begins on the reverse side of the section. It is ground at first on plate A (emery A), then on plate B (emery B) till the section commences to be translucent, or till it is so thin that it is not advisable to continue the process on the rotating wheel. It is, of course, only a matter of experience to know how long to use the various wheels, as much depends on the consistency of the rock material. It is advisable to discontinue the use of plate B before the slice is too much reduced in thickness, so

as to allow a further treatment on glass plate C with the fine emery C. Due precaution should be employed so as not to grind the section uneven. To avoid this the position of the section should frequently be changed in grinding. The section is ready as soon as it is thin enough to allow a complete study of its texture and its component parts, of which a preliminary examination under the microscope will be the best test.

Process of Covering and Remounting.—The section is well rinsed and brushed to remove any emery which might have remained on the glass or which may be accumulated in the pores or fissures of the slice. It is then laid in a vessel with turpentine in order to dissolve the excess of Canada balsam around the slice. In a few minutes it will be softened enough so as to be easily removed by a gentle brushing with turpentine, after which it is well washed and then dried with chamois leather. In order to protect the section and also to increase its pellucity, it is usually imbedded in balsam and covered with a thin glass, the thickness of which should not exceed 0.25 *mm.*, to allow the use of a high magnifying power.

Usually the glass slide on which the mineral slice has been cemented to grind it thin, becomes partly ground during the various operations. It may be replaced with a clean slice on which the mineral slide is mounted as already described.

The separation of the section from the original glass is done by gently heating it till the Canada balsam becomes softened enough so as to allow the removal of the section by a slow sliding to a vessel with turpentine. The heating should be done very gently, otherwise a crust of hard Canada balsam will form around the sections, the removal of which by aid of turpentine or any other dissolving medium will be most difficult.

Another method consists in laying the glass with its slice in a dish with turpentine and to leave it there till the balsam is entirely dissolved, after which the slice of rock may be separated from its glass without any difficulty. The thin slice is transferred to another dish with turpentine and left there till it proves to be entirely free of any foreign matter. It is then taken from the vessel with the point of a knife, rinsed with alcohol and dried, afterwards mounted on a glass which has been warmed, when the slice may be placed upon it with a few drops of Canada balsam.

The whole operation of transferring needs great care, as

some mineral slices will prove to be very fragile on account of their thinness. Sections which are made of a rock material which needed a preliminary treatment with Canada balsam to make it firmer would break entirely to the smallest fragments in the attempt to remove them to another glass, and have therefore to remain on their original glass. Before covering them, the greatest care should be taken to free them entirely from any Canada balsam around the borders of the mineral section, and also from emery, which sometimes can only be detected by aid of a magnifying glass. The re-mounted mineral slice, or the one which could not be removed, as stated above, is covered with a few drops of Canada balsam and laid again upon the warm slab till the balsam has obtained the required tenacity. A thin cover-glass, corresponding in size with the mineral slice is cleaned with alcohol and warmed; it is then taken up with a pair of forceps and dropped slopingly on the slice so as to exclude any air. The section is left on the warm slab till all air bubbles have disappeared which may have been enclosed between the section and cover-glass; the latter is gently pressed upon the section and then allowed to cool. Care should be taken to place the mineral slice and cover-glass in the centre of the glass slide, which will contribute to a nice appearance of the finished preparation. The surplus of Canada balsam around the cover-glass is cleared off by brushing it with turpentine, then it is well rinsed with water and after being dried it should be labeled at once. The labels should be applied on both sides of the preparation and inscribed with the name and locality and geological group of the prepared material. It is well to number the sections and record them in a catalogue in which also a description of the most interesting and principal features of each mineral slice may be given, which will facilitate a future study of the section.

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THE SERPENT AND THE APE.

BY ARTHUR E. BROWN.

WITH the purpose of observing the manner in which the feelings of curiosity and astonishment are manifested in the monkey, Mr. Darwin once introduced a snake into a cage containing a number of those animals, and the results of his experi-

ment he refers to in "The Descent of Man," and also in "The Expression of the Emotions in Man and Animals," as illustrative of the extent to which those qualities are developed in that branch of the animal kingdom.

Reading his statement, the writer conceived the idea that the results obtained were capable of a deeper application than was then given them, and he proceeded to try the experiment for himself. The Monkey House at the Philadelphia Zoological Garden afforded the opportunity, so a dead snake was coiled up in a newspaper, the corners of which were twisted together in such a manner that they would readily come undone, and the package was then set on the floor of a cage containing forty or fifty monkeys of a great variety of species. It was instantly spied by a female *Cynocephalus*, who was the principal leader in all the pranks with which the monkeys constantly amused themselves; she seized the paper by one corner, and set off across the cage, dragging it behind her, evidently intending to have a good time with it.

Before she had gone more than a few feet, the paper became unfolded, and the snake slipped partly out. She instantly dropped the paper and sidled off in a very comical manner with her head over her shoulders, keeping an eye behind her, much as Lot's wife must have looked back on the fascinating terrors of the cities of the plain. No sooner did the rest of the monkeys perceive the dreadful object in their midst, than they approached, step by step, and formed in a circle of six or eight feet diameter, having for its centre the snake quietly coiled up on the floor. None dared, however, to touch it or to go beyond the established line of safety, with the exception of one large Macaque, the acknowledged leader of the cage, who cautiously approached and made an occasional snatch at the paper, apparently to see if the enemy was really as devoid of life as it appeared to her; all the others, meanwhile looking on in breathless attention.

At this point, a string which had previously been attached to the tail of the snake was gently pulled. The serpent lengthened slightly, and the monkeys fled up the sides of the cage, chattering and screaming like magpies; when they got to a safe distance they halted for observation, and after some moments, seeing no further sign of danger, they gradually returned, one by one, to their former position—the large ones in the front rank, and the smaller ones, crowded out by superior strength, forming behind and looking over their shoulders.

This was continued for some hours without the slightest change in the disposition of the monkeys—all of their actions showing a most intolerable fear of the snake, mingled with an attraction or curiosity which would not allow them to remain away from it. This was so universal that not one of the monkeys in the cage was entirely free from it.

The snake was finally taken out, and several other animals belonging to the same class were put in its place, but with very different results. Of a tortoise, for instance, and a small dead alligator, they were at first rather shy, but they at length began to touch them, and in ten minutes they were playing with them, and passing them from one to another with the greatest curiosity.

The same snake was then shown, in turn, to animals belonging to a number of other orders: Carnivores, Rodents, Ungulates, Edentates and Marsupials, but none of them paid it any special attention with the exception of a Peccary (*Dicotyles labiatus*), which, finding it to be dead, seemed disposed to make a meal of it.

Turning from the monkeys and watching, instead, the visitors to the Reptile House, it is evident that the instinctive fear and horror of the snake which is so common as to be almost universal with man, is closely allied to that which has been seen to exist among monkeys. Women readily develop this, as their emotions are more quickly responded to by gestures, than is usually the case in the other sex, and I was specially fortunate, a short time after the occurrence detailed above, in having an opportunity of observing the effect produced by the collection of snakes, upon a lady who was deaf and dumb—by the fact of her disabilities she was shut out, to a very great extent, from the influence—repressing, so far as the expression of the emotions is concerned—of free association with others, and the nature of her feelings was thereby rendered more evident. I was not at all surprised to trace in her, actions and gestures which resembled closely those which I had observed on the part of the monkeys; they evidenced the same fear, the same attraction and the same repulsion, and after watching for a long time, with an expression of the most intense disgust, the cage of Boas, she was at last led away by her friends, protesting that she wanted to stay.

Now if it be asked why this instinctive feeling should be developed in the *Primates* alone—it is probable that as the early dawnings of intelligence in the common ancestor of man and

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Turning from the monkeys and watching, instead, the visitors to the Reptile House, it is evident that the instinctive fear and horror of the snake which is so common as to be almost universal with man, is closely allied to that which has been seen to exist among monkeys. Women readily develop this, as their emotions are more quickly responded to by gestures, than is usually the case in the other sex, and I was specially fortunate, a short time after the occurrence detailed above, in having an opportunity of observing the effect produced by the collection of snakes, upon a lady who was deaf and dumb—by the fact of her disabilities she was shut out, to a very great extent, from the influence—repressing, so far as the expression of the emotions is concerned—of free association with others, and the nature of her feelings was thereby rendered more evident. I was not at all surprised to trace in her, actions and gestures which resembled closely those which I had observed on the part of the monkeys; they evidenced the same fear, the same attraction and the same repulsion, and after watching for a long time, with an expression of the most intense disgust, the cage of Boas, she was at last led away by her friends, protesting that she wanted to stay.

Now if it be asked why this instinctive feeling should be developed in the *Primates* alone—it is probable that as the early dawnings of intelligence in the common ancestor of man and

monkeys began to surpass the power of receiving impressions which existed in other animals, he would be most liable to conceive great dread of that enemy which inflicted upon him wounds of a very different sort from those which he received from his own kind or from animals which approached more or less to his own form, and which also produced effects so subtle in their character and operation, that they would be apt to leave lasting impressions on those animals which were frequently subjected to witnessing them. It should be remembered, also, that the home of the monkey and the spot where, in all probability, the earlier *Primates* first saw the light, is in those regions of the earth which are most infested by numerous and venomous serpents.

These facts will at once suggest to all who put their faith in the theory of gradual development, that the fear of the serpent became instinctive in some far distant progenitor of man, by reason of his long exposure to danger and death in a horrible form, from its bite, and that it has been handed down through the diverging lines of descent which find their expression to-day in *Homo* and *Pithecus*. How strongly marked it is in the latter, the experiment detailed above, corresponding in each of its results with that of Mr. Darwin, bears testimony; and for the evidence of its influence on the mind of the former, turn to the story of the serpent in Paradise; to the signs and symbols of many ancient mythologies, and to the feeling which few men can deny to themselves when they are brought into association with even the most beautiful and harmless member of the order *Ophidia*.

——:o:——

TRACES OF SOLAR WORSHIP IN NORTH AMERICA.

BY EDWIN A. BARBER.

In an article published in the October NATURALIST, entitled "On the Ancient and Modern Pueblo Tribes of the Pacific Slope of the United States," the writer made use of the following expression: "Both paid homage to the sun, or at least looked for a Messiah daily to come to them from the east," to which assertion exceptions have been taken by some ethnologists.

It is held by this class of scientists that the heavenly bodies were never deified by any of the American races. Granting this to be, in some degree, true: That the luminaries, collectively

or individually, were not elevated to the *highest* place in their worship, by any tribe or people in North America, yet the celestial orbs, nevertheless, figured prominently in the list of supreme objects of worship, and many *traces*, at least, of this form of worship are found in the religions of aboriginal races of all ages, from the oldest American people down to the tribes of the present day, especially among those versed in astrology or astronomy.

Although little is known of the Toltecs of Ancient Mexico, it is an established fact that astral worship existed among them. They paid homage to the sun and dedicated their earliest temples to him. The moon, also, they reverenced as his wife and the stars were believed to be his sisters, according to the Mexican Licentiate, Don Mariano Veytia, in his "*Historia Antigua.*" The same writer describes the ruins of San Juan Teotihuacan, the most ancient architectural remains of Mexico, situated about thirteen miles north-east of the capital city. Of these, the largest pyramid, which measured six hundred and eighty feet in length at the base and was estimated at two hundred and twenty feet in height, was dedicated to Tonatinh or Tonatricli, the sun; the next structure in size and importance was inscribed to Meztli, the moon. On the summit of the former a temple was erected, in which was placed an immense statue representing the sun, which faced toward the east.

According to the accounts of Bernardino de Sahagun, a Spanish writer of the sixteenth century, and one who was particularly cautious in his deductions and entirely reliable in his accounts of the religion of the Aztecs, as set forth in his "Historia Universal de Nueva España," solar and lunar worship occurred in the Aztec religion, the sun with them being a spiritual conception. They believed that the heroes who fell in battle or died in captivity, or women who died in childbirth, were immediately transported into the House of the Sun, where they led a life of everlasting delight. From the broad tops of their *teocallis* or temples, the Aztec priests were in the habit of performing impressive, and, in too many cases, bloody ceremonies, in which the heavenly bodies were made to take a prominent part.

After the fall of the Mexican Empire, traces of sun worship were common. Captain Fernando Alarcon, in the year 1540, mentioned having met, on the Colorado River, Indians who worshiped the sun.

The same custom exists among the modern Pueblo Indians of New Mexico. Lieut. A. W. Whipple says of these people that "they are now anxiously expecting the arrival of Montezuma; and it is related that in *San Domingo* (one of the nineteen Pueblo towns), every morning at sunrise, a sentinel climbs to his house-top, and looks eastward, to watch for his coming."

Mr. Whipple also gives a tradition[1] of these Indians which assigns *Acoti* (another Pueblo village, situated on the Rio Grande del Norte, the ancient Tiguex) as his birth-place; but the tale is so at variance with facts and so rich in imagination that it is evidently the invention of some fertile brain. The Spaniards who came among the Pueblos, just after the Mexican conquest, about the year 1539, evidently introduced the name of Montezuma and probably instilled into their minds this idea of his second advent. Thus the worship of heavenly bodies may have become blended with the deification of ancestors; then the sun may have taken the name of Montezuma. Whipple further states that they "smoke to the sun that he may send them antelope to kill, Indians to trade with, and save them from enemies."

Among the Navajos, also, by the same authority, "The sun, moon and stars are sacred, as the authors of seasons of rain and of harvest." He also says of the Zuñians, "Beneath the apparent multiplicity of gods, these Indians have a firm faith in the Deity, the unseen Spirit of God. His name is above all things sacred, and like Jehovah of the Jews, too holy to be spoken. Montezuma is His son and their king. The sun, moon and stars are His works, worthy of their adoration."

The "ancient Pueblos" of the Pacific slope of the United States, whose ruined stone structures are found so numerously throughout portions of Colorado, Utah, New Mexico, Arizona, and probably Nevada, held the sun in high esteem, at least, if they did not worship it. This is shown in the situation of the houses in many localities. In the Cañon of the Rio Mancos,[2] for example, the dwellings are almost invariably found secreted in the cliffs of the *western* bluff, and from their roofs the inhabitants were wont to salute the king of day as he raised himself above the eastern plateau.

[1] Vol. III, Pacific R. R. Reports.

[2] A northern tributary of the Rio San Juan, in the extreme south-western corner of Colorado.

Among the Moqui tribe, to-day, traces of this form of worship still obtain. The religion of their forefathers seems to have degenerated into a mere custom, the origin of which has been long lost sight of in their obscure traditions. Thus, in the course of time, it seems probable, the worship of celestial orbs has given place to hero-worship; solar worship to anthropomorphism, and it is said that the Moquis have ultimately become imbued with the belief that it is a Messiah, in the form of one of their own ancestors, that is, Montezuma,[1] whom they are expecting to arrive from the east. The Moquis and the Pueblos and Zuñis are cognate tribes and doubtless remnants of the ancient Nahuatlac races; hence the similarity of their customs.

As the faint streak of red lights up the low horizon, tall, dark figures appear on the parapets of the seven Moqui towns and remain facing the dawn until the sun has appeared entirely to view. Then the muffled forms drop away slowly and sadly, one by one, for another morn has brought disappointment to the souls of many that have watched so eagerly and persistently for the coming of the great Montezuma. The routine of another Moqui day has commenced; all is bustle and life and the subdued hum of household occupation floats out drowsily on the sullen, sultry air and the sound of the hundred flour-mills (*metates*) grinding steadily on every side, seems, as it issues from the doors and windows of the stone houses, to pause in mid-air like a droning bee. Then scores of busy figures repair with their water-vessels to the verge of the steep bluffs, and disappear in the crevices of the rocks below.

Having presented these facts in support of the assumption that solar adoration entered, to some extent, into the religions of some of the American races, we may sum them up briefly as follows:

1. Fetichism being the commonest form of idolatry, especially amongst the lower races of man, most tribes whose religion is polytheistic, venerate the sun.

2. We can detect vestiges of sun-worship in the ruins of the Toltec and Aztec temples and pyramids and also in the statues which were placed within them.

3. We can observe traces of it in the traditions and observances of savage and semi-civilized tribes at the present day.

4. We notice indications of it in the hieroglyphics or picture-

[1] Motecuhzuma.

writings of most North American tribes, ancient and modern, in which the sun symbol occurs frequently.

5. Also in the position of ruined stone houses which look toward the east, the larger rectangular buildings of the Pacific slope being built so as to face the cardinal points.

6. Finally, we can observe signs of this worship in the orientation of dead bodies in graves.

If we accept these briefly stated facts, there can be no reasonable doubt that the worship of the sun entered, to some degree, into the religions of the American aborigines; how far, we have not the means of determining; yet, quoting the poet Southey's words,—

> "I marvel not, O sun! that unto thee
> In adoration man should bow the knee,
> And pour the prayer of mingled awe and love;
> For like a god thou art, and on thy way
> Of glory sheddest, with benignant ray,
> Beauty, and life, and joyance from above."

——:o:——

A NEW LOCALITY FOR CORDYLOPHORA.

BY S. F. CLARKE.

THIS interesting form of compound hydroid was first discovered in this country by Prof. Leidy, a number of years ago. It was found living "in a slightly brackish pond near the coast," in the neighborhood of Newport, Rhode Island. In October, 1870, it was again taken by Prof. Leidy, this time in the Schuylkill river, near Philadelphia. A record of the same will be found in the Proceedings of the Academy of Natural Sciences, Philadelphia, for 1870, page 113, from which we learn that Prof. Leidy had not decided whether his specimens were distinct from *C. lacustris* Allman. He says "It appears however to be much smaller. Allman says the colonies are several inches and the polyps a line in length. Ours are not more than one-half that size. As a variety it might be named *C. americana*." Unfortunately there are no specimens to refer to and their specific identity must be left undetermined.

On the thirteenth of last October a collecting party of three from the John Hopkins University, consisting of Dr. Brooks, Dr. Uhler and the writer, were so fortunate as to find *Cordylophora lacustris* Allman, living in great abundance within seven or eight miles of Baltimore. The mouth of Curtis' creek, from the point

where it empties its cold clear spring waters into the Chesapeake bay, for a distance of one hundred and twenty yards up the stream, was densely populated with colonies of this beautiful organism. Attached to the water-plants (two species of Potamogeton and a Nitella), and to the rocks in the bed, and on the sides of the creek, they formed a delicate living fringe to every object in the stream. At the mouth of the creek its bed is about forty feet wide with a narrow channel on one side, in which the water, not over three or four feet in depth, flows very rapidly. In the channel where the sunlight is the strongest, owing to the much less abundant growth of vegetable life, where the current is most rapid, and nearest to the mouth, where the changes in the surrounding conditions must be greatest, there we found the colonies in their greatest luxuriance. The waters of the Chesapeake are only brackish in this northern part of the bay, and the tide rises and falls but ten or twelve inches; still this is sufficient to make quite an appreciable difference in the saltness, density and temperature of the water for a number of hundred yards up the stream. The variations in the conditions then must be considerable and the changes must be quite sudden, as they occur with the rise and fall of the tide. The nutritive hydranths too must be possessed of great activity and strength to enable them to catch and retain their food while the water is dashing by them at such a rapid rate. Another visit was made to the same locality in the last week in October, when we found the reproductive bodies of both sexes in great numbers. In these latter the reddish-brown branched spadix showed very distinctly in certain stages of development, ramifying through the opaque-white mass of the gonophore, and in later stages becoming resorbed. The specimens differ in no important respects from the figures and description of Allman. The color is usually a little brighter, being pinkish-red instead of reddish-brown; occasionally there are as many as eighteen or twenty tentacles, and occasionally the shallow annulations at the bases of the ultimate ramuli may be absent, but these all fall within the range of specific variation. Unlike Prof. Leidy's specimens, those from Curtis' creek agree in size with those of Prof. Allman. It is interesting to note that in one of the localities where Prof. Allman collected it, he found it associated with Potamogeton and Lemna, though not attached to them as many of our specimens were.

Cordylophora presents three special points of interest: 1. It

possesses a ramified spadix. 2. It is the only compound hydroid ever found in fresh water, and 3. The reproductive zoöids are developed in a chitinous cup, while the nutritive zoöids are not so developed or protected.

One of the nutritive hydranths showed, in a slight degree, the polystomatous condition which the zoöids of this species at times present; and which has been described and figured by Mr. Hugh Price, of Oxford, England.[1] Mr. Price's specimens were obtained from the Victoria docks, and the polystomatous hydranths were found only on certain colonies. Some of these hydranths possessed as many as five distinct mouths, each one of which was supplied with a series of tentacles; though separated throughout their entire length, they remain united at the base, thus forming a small closely united group from a single hydranth. As the different mouth-bearing parts were very small and without tentacles in some of Mr. Price's specimens, and others were intermediate in size, he is inclined to consider this a regular mode of increase in the hydranths of this species. The single specimen of this kind obtained by us possessed two mouth-bearing portions, each with a set of tentacles and united at the base. Unfortunately it was not preserved and I have been unable to find any others in a similar condition.

There is but one other species of Cordylophora and it may not be out of place to mention it. Kirchenpauer found specimens of a compound hydroid growing upon buoys at highest tide limits in the river Elbe. These he describes in a letter to Busk as a new species of Cordylophora, giving them the specific name of *albicola*. It differs from *C. lacustris* in forming smaller colonies, in having the branches annulated throughout, and the perisarc terminates abruptly.

Habitat.—Grand Canal docks, Dublin, Allman; Commercial and West Indian docks, London, Bowerbank and Allman; a freshwater cistern near London, Busk; Agricultural drains near Lyme Regis, Dr. Lowe; Canal near Ostend, Van Beneden; Schleswig, Semper; neighborhood of Stockholm, Sweden, Retzius; near Rostock, F. E. Schulze; Newport, Rhode Island, Leidy; Schuylkill river, near Philadelphia, Leidy; in basins in the Jardin des Plantes, Perrier; The Baltic, Möbius; Curtis' creek, near Baltimore, Md., S. F. Clarke.

[1] Quarterly Microscopical Journal, Vol. xxiv, New Series xvi, folio 23.

AMŒBA PROTEUS.

BY PROF. JOSEPH LEIDY.

A wonderful creature is the *Amœba*, one of the lowliest of the lowest class of animals, a mere speck of the thinnest jelly endowed with the usual attributes of all living things. Possessing an extensile and contractile power, it puts forth portions of its material in any direction; which portions act as temporary instruments of locomotion and prehension, and which again withdrawn, melt away in the common mass without leaving a trace of their previous existence.

The human body with its intricate mechanism and appliances is a theme of incessant wonder and admiration, but the *Amœba* in its simplicity of structure and capabilities may reasonably excite the same feelings. Though it has long been known, it has recently acquired new interest, from the discovery in higher animals of jelly-specks which in structure and endowments are undistinguishable from the free *Amœba* of stagnant waters. The white corpuscles of the blood travel through the tissues of our body as independent beings, just as the *Amœba* creeps in the mud of a pool, and so alike are they that the wandering corpuscles appear as if they were parasitic *Amœbæ*.

With such a creature as an *Amœba*, of the utmost simplicity, a globule when quiet; of the most variable and ever changing shape when moving, one would not anticipate the recognition of different kinds, of the character of the more fixed specific forms of higher animals. Nevertheless, we observe, *Amœbæ* varying greatly in size, in the general habitual shape they assume in motion, in the extent and usual form of the locomotive prolongations, and in some other points, ordinarily sufficient to render different kinds distinguishable from one another.

Many naturalists think that all varieties of *Amœbæ* are transitory phases of one and the same species, and this view is in some measure confirmed by the occurrence of intermediate or transitionary forms which make it impossible, in many cases, strictly to define the limits of more characteristic and striking forms such as we commonly find. The same reasoning, however, applies with more or less force to higher organic forms, and as with these, it is at least convenient to refer to the different kinds of *Amœbæ* as so many named species.

The first notice we have of the discovery of an *Amœba*, is by Rösel, in a work entitled "Insecten Belustigung," or Recreation among Insects, published in Nurnberg in 1755. Rösel calls the animal the little *Proteus*, and accompanies his description with colored figures engraved by himself.

Linnæus, in the Systema Naturæ, referring to Rösel's animal, named it *Volvox Chaos*, and afterwards *Chaos Protheus*. Nearly at the same time Pallas called it *Volvox Proteus*. Müller subsequently gave it the name of *Volvox Sphaerula*, but later, after having himself observed the animal, described and figured it under the name *Proteus diffluens*.

As the generic name of *Proteus* had been previously appropriated for the well known salamandroid of Adelsberg, Bory de St. Vincent substituted that of *Amiba* for the animal of Rösel and Müller, calling it by the various names of *Amiba divergens*, *A. Röseli* and *A. Mülleri*.

In 1830, Ehrenberg described a comparatively small *Amœba*, which together with all others previously noticed by different authors, he referred to the same species under the name of *Amœba diffluens*. In 1831, in the Transactions of the Academy of Sciences, of Berlin, p. 79, Ehrenberg described what he considered to be a new species of *Amœba* with the name of *A. princeps*. Its characters are as follows: "diameter 1-6th of a line; body transparent, yellowish, with many readily and voluntarily movable blunt processes, four times larger than the *Proteus*." In 1838, in his great work, the Infusionsthierchen, Ehrenberg described *Amœba princeps* as "large, yellowish, equaling 1-6th of a line, provided with a variable number of cylindrical appendages, thick and rounded at the end."

Accompanying the former description there is also one of *Amœba diffluens* as follows: "diameter 1-24th of a line, body clear as water, with mostly three or four variable processes; four times less than the former species." In the Infusionsthierchen the same is described as "branching, rarely extending or exceeding 1-24th of a line, colorless, with processes variable, moderately long, robust, and subacute."

From the descriptions it appears to me that Rösel's little *Proteus* accords with Ehrenberg's *Amœba princeps*, and not with *Amœba diffluens*. Ehrenberg says *A. princeps* is four times larger than the *Proteus*, meaning *A. diffluens*, and not the *Proteus* of Rösel, for

this as represented by Rösel is of greater size than that given by Ehrenberg to *A. princeps*. It would naturally be supposed that an *Amœba* discovered by the earliest observers, with instruments less perfect than those later in use, would be one of the larger and more common forms. That such was the case appears fairly proved by both figures and descriptions.

Rösel, referring to a figure of his little *Proteus*, remarks that in its natural size it looks like fig. A. Now this represents the animal in its quiescent state, in globular form, and the figure measures four-fifths of a line. No *Amœba* has since been recorded so large as this, and we may look upon the figure as somewhat exaggerated, which might readily have occurred without the accurate measuring instruments which came later into application to microscopic objects. Rösel also refers to his having held the *Proteus* at rest with the point of a feather, so that the evidence is sufficient to prove that the *Amœba* was one of the largest kind. Taking size alone into consideration, Rösel's *Proteus* is as far removed in one direction from Ehrenberg's *Amœba princeps*, as *Amœba diffluens* is in the opposite direction. But in other characters Rösel's *Proteus* agrees with the former closely, and not with the latter.

Ehrenberg describes *A. princeps* as yellowish, the *A. diffluens* as colorless. Rösel says nothing of the color of the *Proteus*, but his figures are colored yellowish. Most of Rösel's figures exhibit the characteristic changes of form of the animal in movement, and of one of these he remarks that in its branching it resembles the antlers of the deer.

As regards the concurrence of size and color of Rösel's *Proteus*, it might apply to other large *Amœbæ*, instead of *A. princeps*, as for instance the *A. villosa* of Wallich, or the *Pelomyxa palustris* of Greef, but the changes of form represented as occurring in the *Proteus* of Rösel, approach it rather to the former than to either of the latter.

Müller's descriptions and figures of *Proteus diffluens*, which that author regarded the same as Rösel's *Proteus*, likewise appear to apply to the same animal named *A. princeps* by Ehrenberg, rather than to that which he named *A. diffluens*.

If the views taken, as above expressed, are correct, it must be admitted that the *Amœba princeps* of Ehrenberg is the same animal as the *Proteus diffluens* of Müller and the little *Proteus* of

Rösel. Even consenting to the opinion that all forms of *Amœbæ* may eventually be shown to be transitory phases of the same species, it does not render the determinations of Ehrenberg and his followers, in regard to *A. princeps* and *A. diffluens*, any the less incorrect.

Arriving at the conclusion that the common large *Amœba*, usually assigned to *A. princeps* is the same as the *Proteus* of Rösel, the question arises as to its appropriate name. Of the specific names employed for the little *Proteus*, that of "*Chaos*" is the oldest, but appears to me less appropriate than that of "*Proteus*," applied afterwards. As the latter cannot be used in its generic sense, it might be accepted in its specific application so as to perpetuate the name given to the animal by Rösel, its discoverer. While, therefore, in strict conformity with the rules of zoölogical nomenclature, the little *Proteus* of Rösel, the *Proteus diffluens* of Müller, and the *Amœba princeps* of Ehrenberg, would be called *Amœba chaos*, I would suggest that it should be called *Amœba proteus*.

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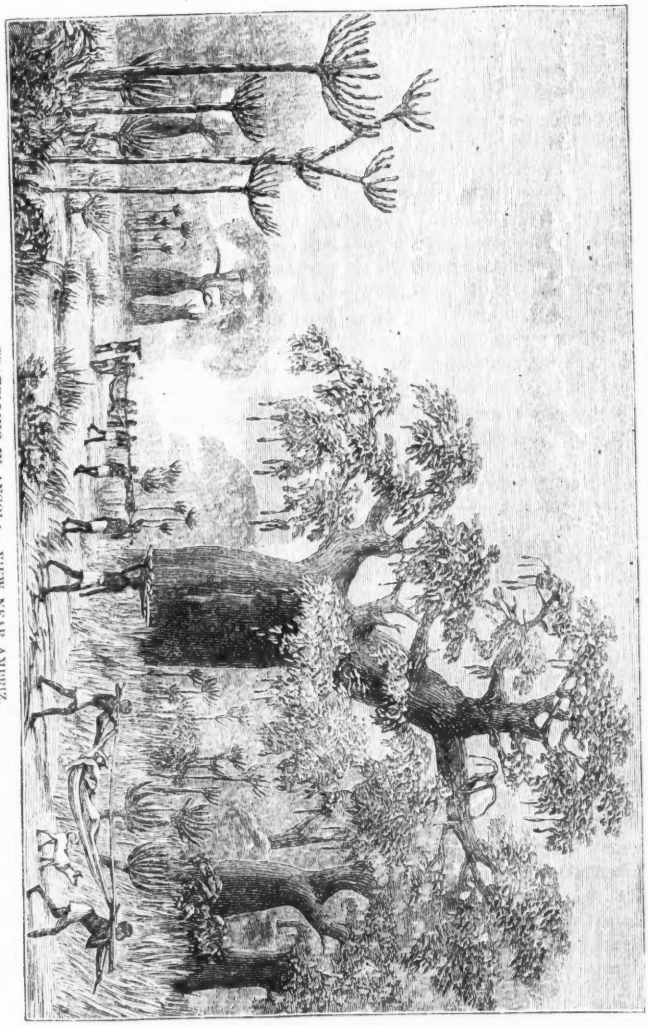
RECENT LITERATURE.

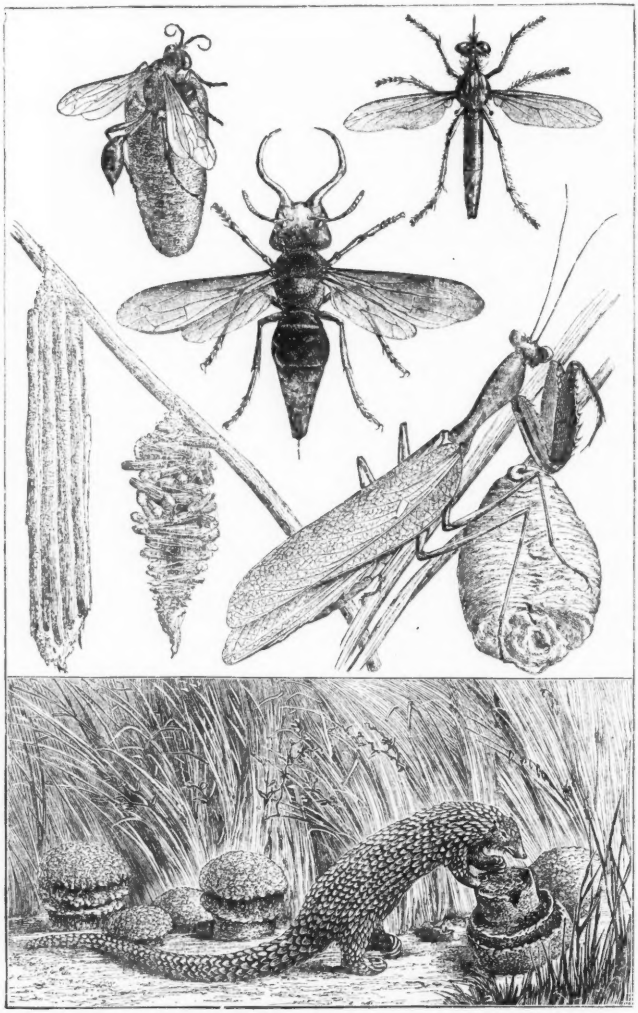
Monteiro's Angola and the River Congo.[1]—Now that Mr. Stanley has discovered the source of the Congo, and crossed the continent to the Coast of Angola, one will turn to the present book for the excellent account it gives of a region so little known. The country described by the author lies between the River Zaire or Congo and Mosammedes or Little Fish bay, comprising ten degrees of latitude. In this region, an interesting and rich part of tropical Africa, Mr. Monteiro lived and journeyed for many years. How the lowland country of the Angola coast may strike the stranger, and how the traveler journeys through its unique scenery, may be ascertained by a glance at the view here given. A number of similar full-page engravings adorn the book, which is full of interesting information regarding the country and its people, their manners and customs, and the effects of slavery upon them. All books of this sort sooner or later exhaust the human features of the country, and we are then regaled with interesting notes regarding the animals and plants, many of them so strange and striking. Some of the characteristic insects are rep-

[1] *Angola and the River Congo.* By Joachim John Monteiro. With map and illustrations. New York. McMillan & Co. 1876. 12mo, pp. 354.



TRAVELLING IN ANGOLA—VIEW NEAR AMBIZ.

resented in the accompanying cut, while the Manis, a type illus-



Pelopœus spirifex and nest.—Devil of the Road.—Dasylus sp.—Caterpillars' nests.—Mantis and nest.—Manis multiscutatum and Ants' nests.

trating the fauna of Southern Africa is seen in one of its characteristic attitudes.

The most wonderful natural product of this country is undoubt-

edly the *Welwitschia mirabilis*. Mr. Monteiro collected specimens of the plant, flowers and cones for Dr. Hooker, which supplied

WELWITSCHIA GROWING IN A PLAIN NEAR MOSSAMEDES.

some of the material for his well-known monograph on this plant. Monteiro states that the country about the River San Nicolau, or 14° S. latitude, seems to be its northern limit. The

following account is extracted by the author from Dr. Hooker's work: "The Welwitschia is a woody plant, said to attain a century in duration, with an obconic trunk about two feet long, of which a few inches rise above the soil, presenting the appearance of a flat two-lobed, depressed mass, sometimes (according to Dr. Welwitsch) attaining fourteen feet in circumference (?), and looking like a round table. When full grown it is dark-brown, hard, and cracked over the whole surface (much like the burnt crust of a loaf of bread; the lower portion forms a stout tap-root, buried in the soil, and branching downwards at the end. From deep grooves in the circumference of the depressed mass two enormous leaves are given off, each six feet long when full grown, one corresponding to each lobe; these are quite flat, linear, very leathery, and split to the base into innumerable thongs that lie curling upon the surface of the soil. Its discoverer describes these same two leaves as being present from the earliest condition of the plant, and he assures me that they are in fact developed from the two cotyledons of the seed, and are persistent, being replaced by no others. From the circumference of the tabular mass, above but close to the insertion of the leaves, spring stout dichotomously branched cymes, nearly a foot high, bearing small erect scarlet cones, which eventually become oblong and attain the size of those of the common spruce-fir. The scales of the cones are very closely imbricated, and contain when young and still very small, solitary flowers, which in some cases are hermaphrodite (structurally but not functionally), in others female. The hermaphrodite flower consists of a perianth of four pieces, six monadelphous stamens with globose three-locular anthers, surrounding a central ovule, the integument of which is produced into a styliform sigmoid tube, terminated by a discoid apex. The female flower consists of a solitary erect ovule contained in a compressed utricular perianth. The mature cone is tetragonous, and contains a broadly-winged fruit in each scale."

Barrois' Embryology of Nemertean Worms[1].—The author of this work is well known for his labors on the developmental history of sponges. His aim in the present essay is to give as complete a history as possible of the normal development of a group of nemertean worms. These are low, in the adult state, non-segmented worms with a wonderfully extensile body, whose young are in some cases (though not in those mentioned by the author) related in form to those of the true Annelids, being segmented. M. Barrois concludes from a study of the development of a number of genera (*Lineus, Amphiporus, Tetrastemma, Polia,*

[1] *Mémoire sur l'Embryologie des Némertes.* Par M. Jules Barrois. (Annales des Sciences Naturelles, Sixtième Série. Tome vi. Paris, 1877.) 8°, pp. 232, with 12 plates.

Cephalothrix, Drepanophorus) that they pass through three principal stages.

I. A bilateral Gastrula-form.

II. A Gastrula, with the middle layer (mesoderm) arising from the exoderm, and composed of two principal rudiments: (1) the muscular layer, thin and uniform; (2) the recticulum, extending through the entire body-cavity, and represented in the embryos of *Lineus obscurus* by oil globules.

III. The longitudinal layer is enlarged in advance of the lateral organs into a solid mass; the nervous system arises over all the internal extent of the layer thus complicated. The internal cavity is divided into a system of cavities separated by partitions, all along which the reticulum is applied in a continuous layer.

These three states, which may be successively observed in the embryo of a nemertean worm, appear to exist in a more explicit way in Prorhynchus, where state II seems to be represented by an adult, free-living Planarian. The Nemerteans, then, appear to have derived from a sudden modification of the Planarian type, and justify, in the author's opinion, the establishment of homologies between the two groups.

THOMAS' NOXIOUS INSECTS OF ILLINOIS[1].—This interesting report is divided into two parts, the first relating to horticultural entomology, and the second comprising the introductions to and first part of a manual of economic entomology for the State of Illinois, including the Coleoptera. The first part contains excellent advice concerning the best means of contending against insects injurious to the orchard, especially general and preventive remedies, which are always the best and usually the last to be applied. Considerable attention is bestowed on the birds found to be useful in the orchard, and a list is given of the most important species. The report will prove very useful and timely to the farmers and gardeners of Illinois, for whose sole use it has been compiled.

CONTRIBUTIONS TO THE FOSSIL FLORA OF THE WESTERN TERRITORIES. PART II. THE TERTIARY FLORA. BY L. LESQUEREUX.[2]—In this important work Prof. Lesquereux gives to the world the results of many years of laborious investigation of the remains of plants which have been discovered in the later horizons of the Rocky Mountain region from the Laramie formation upwards, by the U. S. Geological Survey under Dr. Hayden, and by Messrs. Berthoud, Le Conte, Denton and Allen, Profs. Lakes and Cope, Lieut. Vogdes and others. After considering the stratigraphy of

[1] *Sixth Report of the State Entomologist on the noxious and beneficial Insects of the State of Illinois.* The first biennial Report. By CYRUS THOMAS, PH.D., State Entomologist. Springfield, Ill., 18 7, 8°, pp. 174, iv, ii.

[2] *Report of the United States Geological Survey of the Territories.* F. V. HAYDEN, U. S. Geologist-in-charge. Vol. vii. 4to, pp. 366. 1878.

the lower lignitic formations of New Mexico, Colorado and Wyoming, which he with others regards as of undoubtedly cretaceous age, he proceeds to describe that of the true "lignitic," or as it will now be called, the Laramie formation. The descriptions refer chiefly to the exposures which the author has visited along the line of the Union Pacific railroad, and but little information is furnished respecting the strata of the Laramie on the middle and upper Missouri and the Saskatchewan regions. Then follow the detailed descriptions of three hundred and twenty-nine species of plants, many of which are represented by numerous remains, and from various localities. This portion of the work is illustrated by sixty-five plates, well executed by T. Sinclair & Son, of Philadelphia. Here the author supplies his fellow students with the most valuable evidence as to the characters presented by this vast department of life during the past periods of the existence of our continent.

The work closes by a general discussion of the meaning of the evidence with regard to the mutual relations in time of the various formations treated of, and their correspondences to the horizons of other countries. He reaffirms the conclusions previously stated, viz: that the floræ from the base of the Laramie upwards is of tertiary age. He divides the series into four groups, all of which (p. 352) he regards as belonging to the "Lignitic formation." He thus parallelizes them with the European standards (p. 354). "I admit the lower group as Lower Eocene; the second group, which seems intermediate between this and the Carbon, may be Upper Eocene; the relation of the third group is by its plants with Lower and Middle Miocene of Europe, and that of the fourth with the Upper [Miocene]. These are like the first outlines traced for the preparation of a map; they may be erased or modified, the spaces have to be filled as our acquaintance with the Tertiary becomes more intimate."

The evidence in favor of the correctness of these positions is rather more abundant than that derivable from the animal remains, and is handled with care in Prof. Lesquereux's discussion. There is no reason why his conclusions should not be accepted by students in other departments. Nevertheless the value of the evidence derivable from these vegetable remains is only to be fully understood by comparison with that derived from all other sources.

As a student for the last ten years of the vertebrate remains obtained from these formations, I have to say, as heretofore, that the evidence they offer as to the age of the horizons both in their mutual relations and their relations to the formations of other countries, is quite different from that presented by Prof. Lesquereux. It is well known that I was the first to show that the vertebrate fauna entombed in the lignitic formations to the summit of the Laramie, or to the summit of Prof. Lesquereux's first

division, and perhaps his second division, is of mesozoic and cretaceous type; and also that that of the Wasatch (or Green river) epoch, or Prof. Lesquereux's fourth group, lower division, is of Eocene Tertiary age. The evidence in favor of these positions has been steadily accumulating since I first announced them in 1869 and 1872, no exceptions have come under my notice, and their applicability has been extended to all parts of the North American continent which have yet been explored. In fact the most important interruption in the vertebrate life of North America is found between the Laramie and Wasatch epochs, and there only can the line between the Cretaceous and Tertiary periods of this continent be drawn.

The evidence in favor of this position has been in a measure overlooked by Prof. Lesquereux. He remarks (p. 30): "As no kind of cretaceous animal remains have been discovered in the Lignite of Colorado, none either in that of the north, generally called the Fort Union group, the question of age essentially bears upon that Bitter Creek series. The line of demarkation between the cretaceous and the tertiary is placed by Prof. Cope above the Black Buttes Saurian Bed." The facts as regards the amount of vertebrate evidence in favor of the cretaceous age of the Laramie, are as follows: In 1869 I determined the vertebrate remains from the Fort Union beds of Dakota, which had been supposed to be mammalian, to be reptilian, and indicative of the Mesozoic character of the Fort Union beds of the Missouri. The number of species furnished by this region is seven. In 1872 I obtained the *Agathaumas sylvestre* from the leaf-beds at Black Butte station in the coal region of Wyoming, and made the determination of its Dinosaurian character to which Prof. Lesquereux alludes. In 1872 I collected, in the Laramie formation of Colorado, nine species of vertebrates of the same genera, and sometimes species, as those previously determined from Dakota. In 1875 I determined the same genera and in some instances the same species from specimens sent by Dr. Dawson from the Saskatchewan. This collection included nine species. In 1876 I made an exploration of the Judith River basin in Montana, and obtained a large collection of vertebrate remains, embracing forty-eight species. These I showed to be of the same general character as the species already obtained from the localities previously mentioned, having a predominatingly cretaceous type, and close affinities and sometimes identity with those I had previously described. The vertebrate species now known from the Laramie formation are sixty-three, enough to determine clearly its position in the series; and study has shown it to be of uniform character over the entire continent north of New Mexico, and of general cretaceous type. Prof. Lesquereux seeks to explain the presence of the Dinosaurian *Agathaumas sylvestre* in a bed of Tertiary plants as did Prof.

See Bulletin U. S. Geological Survey Territories. III, No. 3, 1877.

Dawson, and has apparently not noticed my reply to the remarks of the latter gentleman. He observes (p. 351): "We may admit, however, that while the Tertiary age was at its beginning represented as a land formation as seen by its flora, a cretaceous marine fauna may have still locally persisted in deep seas. Facts of this kind are recorded in the European geology. The presence of the saurian *Agathaumas* in the lignite bed of Black Buttes is then certainly explainable as denoting the wandering of that animal out of its domain, and its death by penetrating into a peat bog and being irretrievably swallowed up by its soft matter."

Now it does not seem to be as well known as it should be that no such thing as a marine Dinosaurian has yet been discovered, and that the numerous *Vertebrata* of the Laramie formation are as generally terrestrial or, (in the case of the fishes) fresh-water in their character, as are the plants described in his valuable report now under review. I may here note the fact that Maj. J. W. Powell, who has followed Dr. Hayden in regarding the Wasatch epoch as of Tertiary age, was disposed at one time to place its inferior boundary below the *Agathaumas* bed, so excluding the latter from the cretaceous series. Last season's examination of the locality at Black Butte, by Prof. C. A. White, has convinced that gentleman that the boundary between the cretaceous and Tertiary formation is where I placed it, above the *Agathaumas* bed.

As regards the Lower Eocene character of the Wasatch beds, I have furnished abundant and conclusive evidence in various publications, which are summarized in the Vol. IV, of the Final quarto reports of Lt. Geo. M. Wheeler, published in 1877. This period witnessed the introduction of the Mammalian fauna in large numbers to North America, and forms the beginning of Tertiary time. Prof. Lesquereux's conclusion that it is of Miocene age, is negatived by the *Vertebrata*, which are typically lower Eocene. We must conclude then that not only was a Cretaceous fauna contemporary with a Tertiary flora in North America, but that the flora spans the greatest gap in the history of vetebrate life. We must also believe from the evidence offered by Prof. Lesquereux, that a Miocene flora was contemporaneous with an Eocene fauna. Since a Jurassic flora is still, according to Dr. Hector, existing in New Zealand, it must be evident that the positions of strata in the scale will be far more accurately determined by a consideration of the *Vertebrata*, than of any other form of life.—*E. D. Cope.*

Recent Books and Pamphlets.—National Academy of Sciences. Biographical Memoirs. Vol. I. Washington. 1877. 8vo, pp. 343.

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Sponges considered as a distinct sub-kingdom of animals. By A. Hyatt. (From the Proceedings of the Boston Society of Natural History, Vol. xix, Nov. 1, 1876.) 8vo, pp. 5.

Geological Survey of Canada. General Notes on the Mines and Minerals of

economic value of British Columbia, with a list of localities. By Geo. M. Dawson. (Reprinted from the Canadian Pacific Rai way Report, 1877.) 8vo, pp. 47.

Geological Survey of New Jersey. Annual Report of the State Geologist for the year 1877. Trenton, N. J. By George H. Cook. 1877. 8vo, pp. 49. With a map.

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The Erysiphei. By C. E. Bessey. (Extracted from the Seventh Biennial Report of the Iowa Agricultural College, December, 1877.) 8vo, pp. 18, 2 plates.

Collembola borealia — Nordiska Collembola, beskrifna af Tycho Tullberg. Öfversigt af Kongl. Vetenskaps akademiens Förhandlingar, 1876. No. 5. Stockholm. 8vo, pp. 20, 4 plates.

III. New Tineina from Texas. IV. Food-plants of Tineina. V. Index to the Described Tineina of the United States and Canada. By V. T. Chambers. (Extracted from the Bulletin of the U. S. Geological Survey, F. V. Hayden, in charge.) Washington. 1878. 8vo, pp. 88.

Catalogue of Phaenogamous and Vascular Plants of Jefferson county, Indiana. By Charles R. Barnes. To which is added a list of plants growing in Clark county. By John F. Baird. 8vo, pp. 9.

On the Classification of Butterflies, with special reference to the position of the Equites or Swallow-tails. By S. H. Scudder. (From the Transactions of the American Entomological Society, Philadelphia, June, 1877.) 8vo, pp. 11.

On the first discovered Traces of Fossil Insects in the American Tertiaries, and on two new Carabidæ from the Interglacial Deposits of Scarboro' Heights, near Toronto, Canada. By S. H. Scudder. (Extracted from the Bulletin of the U. S. Geological Survey, F. V. Hayden, in charge, Washington, 1877.) 8vo, pp. 24.

Orthopteren vom Senegal. Gesammelt von Dr. Franz Steindachner. Bearbeitet von Dr. Hermann Krauss. (Vorgelegt in der Sitzung aus 21, Juni, 1877.) Mit 2 Tafeln. 8vo, pp. 35.

Mound-making Ants of the Alleghenies. By Rev. H. C. McCook. John A. Black, Philadelphia. 8vo, pp. 43, 5 plates.

On the Variation of the Decorticated Leaf Scars of certain Sigillariæ. By Herman L. Fairchild. (From the Annals of the New York Academy of Sciences, Vol. 1, No. 2.) 8vo, pp. 3, 2 plates.

On the Variations of the Leaf Scars of Lepidodendron aculeatum Sternberg. By Hermann L. Fairchild. (From the Annals of the New York Academy of Sciences, Vol. 1, No. 3.) 8vo, pp. 14, 5 plates.

A Synopsis of the North American Species of the genus Alpheus. By J. S. Kingsley. (Extracted from the Bulletin of the U. S. Geological Survey, Vol. iv., No. 1.) Washington, Feb. 5, 1878. 8vo, pp. 10.

On Notiothauma Reedi, a remarkable new genus and species of Neuroptera from Chili, pertaining to the family Panorpidæ. By R. McLachlan. (Extracted from the Transactions of the Entomological Society of London, 1877. Part iv, December.) 8vo, pp. 4.

Zur Physiologie und Histologie des Central nervensystem von Helix pomatia. Von Dr. Hermann von Ihering. Göttingen, 1876. 12mo, pp. 6.

Die Gehorwerkzeuge der Mollusken in ihrer Bedeutung für das natürliche System derselben. Von H. von Ihering. Erlangen. 1876. 8vo, pp. 33.

Ueber die Ontogenie von Cyclas und die Homologie der Keimblätter bei den Mollusken. Leipzig. 1876. 8vo, pp. 20.

Zur Kenntniss der Eibildung bei den Muscheln. Von Hermann von Ihering. Leipzig. 1877. 8vo, pp. 14.

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Ueber die systematische Stellung von Peronia und die Ordnung der Nephropneusta v. Ih. Von H. v. Ihering. Erlangen. 1877. 8vo, pp. 38.

Ueber die Byssus des *Mytilus edulis*. Von Tycho Tullberg. Upsala. 1877. 1 plate, 4to, pp. 9.

GENERAL NOTES.

BOTANY.

CLEISTOGAMOUS FLOWERS IN DANTHONIA.—At the end of August last, Mr. Edwin Faxon and I, in the White Mountain Notch, collected a form of *Danthonia* which interested us much; although resembling *D. spicata* in its panicle, its culm was stouter than we had ever seen in this species, greatly swollen above the nodes, readily disarticulating as we sought to secure a supply (the plants being mostly out of season at that time), and showed in some specimens a panicle below the terminal one bursting from the upper sheath; the root-leaves as well as those of the culm were unusually large and long for *D. spicata*.

Mr. Chas. E. Faxon submitted his brother's specimens to Mr. C. F. Austin, who, though he thought the plant might be a form of *D. spicata*, described it under the provisional name of *D. Faxoni*, observing especially the unusually long and pointed teeth of the lower palet, and assuming that the culm of *D. spicata* is always single.

Not long since, on one of the mountains of Western Vermont, I came across specimens of *D. spicata*, which at once suggested to me the plants I had seen in the White Mountains, and tearing away their sheaths, I found concealed flowers in every specimen. Following up this clue to a solution of the puzzle presented by the White Mountain plant, I have since examined a large number of specimens of *Danthonia spicata*, and in every instance have detected flowers concealed in the sheaths, even the most depauperate plants with slender culms less than a foot in height showing at least rudiments of flowers.

Within the sheath on the side opposite its slit the culm is concave from the node upward, and the chamber thus formed is occupied by a spikelet one to ten-flowered, sessile on the node, and subtended by two awl-shaped, unequal, sometimes subequal, plumes, two to six lines long, and very rough on their back; or, in the case of the stouter plants, and in their upper sheaths, by two or more such spikelets, standing still sessile, side by side; or again, as in the case of the White Mountain specimens, by small panicles approaching in character the terminal one. In the smallest plants these spikelets are often undeveloped beyond a pair of short glumes; in all they are simplest toward the base of the culm; in the lower sheath of ordinary plants they are one-flowered; when several-flowered they are filiform, rather moniliform, the flowers being so distant on their rachis as barely to touch each other.

In the simplest state of the flowers, that is in the one-flowered, or few-flowered, spikelets near the base of medium-sized culms, their lower palet is smooth and shining, quite coriaceous, and, though tapering into an acuminate point, is entirely awnless. As

the spikelets become more highly developed, or are multiplied, toward the summit of the culm, particularly in the stouter specimens, the flowers generally approach in character those of the terminal panicle, their outer palets becoming by degrees thinner and rougher, and assuming an awn, at first short, straight, and terminal, then becoming more and more twisted, and placed lower and lower between the teeth of the notched apex. The glumes, also, are gradually modified, until as shown by the specimens from the White Mountain Notch, those of the upper spikelets in the panicle issuing from the sheath of the upper leaf are scarcely different from those of the terminal panicle. These hidden flowers are perfect, the palets of moss of those examined being found to enclose well-developed seeds. May they not be considered as a special means for the dissemination of this plant, which as a matter of fact is rapidly spreading over the drier soils of Vermont to the great detriment of agriculture, an ultimate scourge, completing the desolation begun by indiscriminate use of the axe, and helped on by the consequent increasing droughts of our summers? The seeds borne at the top of the culm of this grass fall readily for the most part in mid-summer; without aid in their dispersion, they must lodge in their immediate vicinity. But these concealed seeds securely stored within the sheath of the culms, when these are disjointed and swept away before the winds of autumn and winter, go to plant the species in new fields.

Danthonia compressa Austin, exhibits precisely the same cleistogamous flowers as *D. spicata*, and its culm disarticulates even more readily. In one of the few specimens of *D. sericea*, examined with this view, I find a one-flowered spikelet in its lower sheath; in this species, however, as it may be worth mentioning, the culms seem less stiff and not so easily separable at the joints.

In other genera of this family are these flowers to be found. I have already observed them in *Vilfa*, *Holcus*, and *Arrhenatherum*. —*C. G. Pringle.*

Ferns of North America[1].—In the present number plates are given of *Asplenium ebeneum* Aiton., *Asplenium ebenoides* Scott. Three species of *Botrychium*, namely, *B. lunaria* Sw., *B. lanceolatum* Ang., and *B. coreale* Milde, *Cheilanthes lanuginosa* Nutt, and *Cheilanthes californica* Mett. All of these except the last are described at considerable length. Prof. Eaton begins in each case with a concise diagnosis. This is followed by the synonymy and a list of localities, after which there is given in clear language a detailed description of typical specimens and of the troublesome varieties. The drawings by Mr. Emerton and the lithographic printing are well done. We must again express not only our pleasure at the excellence of the work, but our surprise at the remarkably low price at which it is furnished.—*G. L. G.*

[1] By Prof. Daniel C. Eaton. Part 2—Naturalists' Agency, Salem, Mass., $1.00.

A Fossil Fungus.—One of the most interesting recent discoveries in palæo-phytology has just been made by the English cryptogamist, Mr. Worthington Smith, in the detection, in the coal-measures, of a fossil fungus nearly allied to that which produces the potato-blight, and which he has named *Peronosporites antiquarius*. Fossil Fungi were not previously altogether unknown. Some years ago Mr. Carruthers, the keeper of the botanical department in the British Museum, detected mycelial threads among the cells of a fossil fern (*Osmunda*) from the Lower eocene strata of Herne bay; and Mr. Darwin has stated that fungus threads in a fossil state in silicified wood were shown to him more than forty years ago, by Mr. Robert Brown. Messrs. Hancock and Asthey have also described in the *Annals and Magazine of Natural History* (4th ser. vol. iv, 1869, p. 221, t. ix, x), under the name of *Archigaricon*, what may be a fossil *Peronosporites* from the Crawlington black shale. The specimen examined by Mr. Worthington Smith (the fungoid nature of the organism having been first suggested by M. Carruthers) was seen within the vascular axis of a *Lepidodendron*, and is thus described by that gentleman:—It consists of a mass of mycelia and zoosporangia (or oogonia). Beginning with mycelium, a close examination shows that it is furnished with numerous joints or septa. If, therefore, any reliance is to be placed upon the modern distinguishing characters of the now living species of the genera *Peronospora* and *Pythium*, as furnished by a septate or non-septate mycelium, the fossil parasite belongs to the former, and not to the latter genus, nor to any of the Saprolegineæ. The oogonia do not agree with those of *Cystopus*. Within many of the fossil oogonia the differentiation of the protoplasm into zoospores is clearly seen; but if any doubt could exist as to the exact nature of this differentiation, then other oogonia (or zoosporangia) on the same slide show the contained zoospores with a clearness not to be exceeded by any living specimens of the present time. It is a very remarkable fact that the oogonium precisely resembles, in size and other characters, average oogonia of the present day, especially those belonging to *Peronospora infestans*. The contained zoospores are, moreover, the same in form and dimensions with those of *P. infestans* when measured to the ten-thousandth of an inch. The organisms are in fact apparently identical; and the average number of zoospores in each oogonium is also the same, viz.: seven or eight. The aërial condition of the fungus has not been observed. Mr. Worthington Smith suggests, in conclusion, that we probably have in *Peronosporites antiquarius* one of the primordial plants from which both the great families of Fungi and Algæ may possibly have descended. There is no doubt that the Peronosporeæ and Saprolegineæ are very closely allied; and yet the former are commonly placed among Fungi, the latter among Algæ; and we may possibly here have the point of departure from which the two families branched out.—*A. W. Bennett.*

Botanical News.—The Transactions of the Academy of Science of St. Louis, Vol. iii, No. 4, 1878, contain the following botanical papers of interest, by Dr. George Engelmann: On the Oaks of the United States; The Flowering of *Agave shawii* (with a plate); The American Junipers of the section *Sabina* (with cuts); A Synopsis of American Firs (*Abies* Link); Oak and Grape Fungi.

Dr. Aug. Jæger continues his Genera et Species Muscorum, with reference to the mosses of the globe, in the Proceedings of the Natural History Society of St. Gall. The Proceedings of the Royal Danish Academy of Science contain an elaborate paper by Eugene Warming, on the development and morphology of the Cycads (with three plates). His studies were principally based on *Ceratozamia longifolia* and *brevifrons*, and also different species of *Zamia*, *Cycas* and *Dioon*. An important paper by Prof. E. Strasburger, on fructification and cell-division, appears in the Jena Zeitschrift, Bd. 11, Heft 4.

In the extraordinary volume of the Nova Acta of the Royal Society of Upsal, Prof. Fries describes the species of Swedish *Polybalsticæ*. The *Botanologia* of R. F. Fristedt is for the first time published. F. R. Kjellman discusses the algæ of the West Coast of Nowaja Semlja and Wajgatsch. Axel N. Lundström's critical remarks on the willows of Nowaja Semlja, and their genetic relations, is illustrated by an interesting plate, while Wittrock's elaborate paper on the development and systematic arrangement of the Pithophoraceæ, a new order of Algæ, will be of much interest to algologists.

Dr. Oscar Drude contributes a valuable paper to Petermann's *Mittheilungen* for January, on the geographical distribution of palms. The *Journal of Botany* for January contains a paper by A. Dickson on the structure of the pitcher of *Cephalotus follicularis;* the February number, Side-lights on the structure of Composites, and a note on the Dimorphism of Restiaceæ, by M. T. Masters.

The Bulletin of the Torrey Botanical Club for January, contains a valuable paper by G. E. Davenport, on Vernation in Botrychia, with a plate. In the Botanical Gazette for February, A. W. Chapman continues his enumeration of new Floridian plants.

ZOÖLOGY.[1]

Notes on the nesting habits of the English Sparrow.—Statements frequently come under my observation regarding the habit of this bird of appropriating the nests of other species for its own use. A prominent example of this kind came to view during the spring of 1875, at Reading, Penna. In 1874 I occupied a sleeping apartment, about eight or ten feet from the windows of which a pair of robins had constructed a nest in the

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A.

branches of a maple tree. The female had scarcely time to warm her abode before a lot of sparrows came and during the mêlée the former was vanquished and driven away. The nest was then pulled up and partially destroyed. In the spring of 1875 a pair of robins came (and I doubt not but that they were the same), examined the débris which had been pretty well settled during the winter, and commenced the construction of another nest. This time they were unmolested until after the eggs had been deposited. I commenced to feel more secure for my little neighbors, but my gratification was of short duration. About a week had elapsed when the sparrows made another attack, finally conquering their opponents and driving them away. They tore the nest into one mass of rubbish, when all but one pair retired, which then worked an entrance and fitted it up, where they remained until two broods were hatched. In the spring of 1876 the limbs were sawed off of the trees, preventing probably a recurrence of similar exhibitions of strife, or in other words, downright cruelty.—*W. J. Hoffman, M.D.*

The largest of all fresh-water Polyzoa.[1]—There is in this neighborhood a fresh-water lake in which are produced curious jelly-like substances, covered on the outside with small seed-like bodies. These structures are of various sizes, from that of a cocoa-nut to that of a half-bushel basket, and are transparent for a thickness of two or three inches, the inside of the mass being tinged with red and green. They apparently begin their growth on a submerged stick or stone, and when grown large loosen and float about for a time, and then gradually dissolve or decay. The body of the jelly-mass is firm and cuts with a knife nearly as hard as a ripe melon.—*K. Cruger, West Chester Co., N.Y.*

Mr. Cruger apparently refers to the largest of all known fresh-water Polyzoa, *Pectinatella magnifica* Leidy.

Two New Genera of North American Fresh-Water Fishes have been recently described by Prof. D. S. Jordan, which are of considerable interest. One of them belongs to the family of the *Catostomidæ*, and is distinguished by a peculiar form of the mouth and lips, which approaches that seen in the Cyprinoid genus *Exoglossum*. The only species known is named *Lagochila lacera*, and is found in some of the tributaries of the Tennessee river. The other genus is Acanthopterygian, and is placed by Prof. Jordan between the *Percidæ* and *Aphredoderidæ*. It agrees with *Aphredoderus* in several particulars, but has a posterior vent. The typical species is quite small, and is found in the rivers of Arkansas and Texas. It is the *Elassoma zonatum* of Jordan.

A New Genus of Cystignathidæ from Texas has recently been determined by Prof. Cope from specimens discovered by G.

[1] Abstract of a letter communicated by the Smithsonian Institution.

W. Marnock, near San Antonio. It is allied to *Phyllobates*, being, like that genus, without vomerine teeth, but the nasal bones form a close continuous roof as in *Hylodes*. The species is of medium size, and is called by Cope *Syrrhophus marnockii*. With it were found specimens of the Eastern species of Hylid, *Chorophilus oculatus*.

Bassaris astuta in Oregon.—Mr. A. H. Wood, of Painted Post, New York, has lately sent to the Smithsonian, at my request, a specimen of *Bassaris astuta* taken in a trap, on Rogue river, thirty-five miles north-west of Jacksonville, *Oregon*, in December, 1877. The person who took it had hunted and trapped in the region for many years, but had never before seen such an animal. This occurrence is interesting as still further extending the known range of the species: see Baird, Mamm. N. A. 1857, 147 (Arkansas and California and south through Mexico); Sullivant, Am. Nat. vi. 1872, 362 (Ohio); Coues *ibid.* 364 (Ohio and Kansas).—*Elliott Coues, Washington, D. C.*

Leptodiscus medusoides, a new form of Noctiluca.—In the *Jenaische Zeitschrift*, Neue folge, 4th Band, 3d Heft, 1877, Richard Hertwig, under the above name, describes an exceedingly interesting Noctiluca-like organism which he had the good fortune to discover in the Harbor of Messina, during the winter of 1876–77. This new form is perfectly discoid in shape, with the flagellum characteristic of *Noctilucæ*. Its size varies, measured across the disc from 0.6 mm. to 1.5 mm. The disc is thickest in the centre, somewhat raised or convex on the dorsal side, while the ventral is concave; near the ventral surface and in the centre, there is a bipartite, ovoid nucleus, the smaller half of which is homogeneous, the larger, granular. Numerous oil globules are imbedded just beneath the dorsal integument, but with the exception of the whitish spot (granular area), in the centre the disc is clear and transparent, exhibiting slight iridescence of the convex side.

As the names indicates, this organism is medusa-like, but this likeness becomes still more strikingly manifest when the organism moves. As in *Medusæ*, change of place is effected by the powerful contraction and dilatation of the umbrella-shaped body, like the former forcing the water suddenly from the cup-like cavity. In the energy and rapidity of the contractions Dr. Hertwig says it is not behind any *Medusa*, provided the little creature is touched with a glass rod. Under these circumstances it darts like a *Rhopalonema* through the water as swiftly as an arrow, by the quickly succeeding pulsations or contractions of its umbrella-shaped body. The strongest contractions were produced by osmic acid, the creature under the action of this reagent becomes bell-shaped, about half as wide across the free border of the bell as it is high. As in *Medusæ*, the animal has the power of bending portions of the free border of the umbrella inwards, or sometimes the opposite

halves of the disc become bent towards each other like the opposite valves of a mollusc. Altogether the discovery is a most interesting one, showing as it does the wide range of form and physiological differentiation which may be exhibited by a very restricted group of simple organisms.

MARGARITANA DEHISCENS Say.—A study of the anatomical parts of various species of *Unionidæ*, leads to opinions somewhat different from those set forth by Mr. Lea in the last edition of his invaluable *Synopsis*, and suggests a revival of the discussion as to the propriety of dividing the genus Unio, as now constituted, into several genera or sub-genera. The soft parts of these molluscs have been found to present very great differences, not only in the position and relation of the various organs, but also in regard to their degrees of development.

The species known as the *Margaritana dehiscens* of Say, presents characters that set it entirely apart from the other species of that group examined in connection with it. These characters will be fully set forth in a future article, when further studies and observations shall have been made. It is suggested that this species belongs to the genus *Leptodea* of Rafinesque. It exhibits certain characters that would seem to ally it to the genus *Mycetopus* from South America.—*A. G. Weatherby.*

ON TEXAN STREPTOPOMATIDÆ.—The writer has recently had the pleasure, through the kind services of Mr. G. W. Marmock, of Bexar county, Texas, of examining specimens of the exceedingly rare *Melania pleuristriata* of Say, which, before Mr. Marmock's discovery, was regarded as a lost species, no types being in existence.

A careful study of the linguals of this species, as well as various characters of the shell, and the extreme south-western geographical range, suggests its close alliance to the genus *Pachycheilus* Lea.

I am informed by Mr. Marmock that it inhabits the springs of south-western Texas, in this respect having the habit of the East Tennessee *Goniobasis*. A species closely allied, or a very persistent variety, for which I suggest the name, at present, of variety *marmocki*, accompanies the specimens, together with an unidentified *Planorbis*, a *Physa* and a *Lymnæa*.

Mr. Marmock also found, in the same region, the very rare *Holospira roemeri* Pfr., the *Macrocceramus pontificus* Gould, and the *Helix photus* Pfr.

The description of the *Pachycheilus* was published by Mr. Say in the New Harmony Disseminator, December 30, 1839. Descriptions may also be seen in the following works: Descr. of New Shells, 8vo, p. 15, 1840; Binney's Edition of Say, p. 140.

For the identification of the species, and the above references to the description, the writer is indebted to the kindness of Mr. Geo. W. Tryon, Jr.—*A. G. Weatherby.*

ANTHROPOLOGY.[1]

ANTHROPOLOGICAL NEWS.—In the *Geographical Magazine*, for February, will be found an interesting autobiography of Hans Hendrik, an Eskimo, who served with Kane, Hayes, Hall, and Sir George Nares, translated by Dr. Rink.

Dr. Hoffman, Assistant Surgeon U. S. A., communicates the following description of a practice among the Dakotas, of Grand river, D. T., for producing abortion: The hair from the tail of the black-tailed deer is cut up into short pieces and fried in the fat of black bears' paws. The patient swallows as much of this as is thought necessary to produce the effect. There are certain old squaws who are recognized as "general assistants," and nurses to lying-in women, and they are frequently called in to aid young and old women in producing abortion. The patient sits upon the lap of the nurse, who reaching around the abdomen and interlacing her fingers to get a secure hold, hugs her victim with all her strength repeatedly and for a long time. This frequently ends to the satisfaction of the operator and subject.

Mr. Paul Schumacher, writing from San Francisco, makes the following communication with reference to the perforated stone discs found so abundantly in Southern California and elsewhere: "With reference to the employment of these objects to give weight to digging-sticks, I received my information from a half-breed Indian who had seen, in his youth, the last aboriginal inhabitants of the Island of Santa Cruz, still occupying the *rancheria* at Prisoners' Harbor, in which I made excavations for the Smithsonian Institution three years ago. I have since followed up the subject, and although positive proof is wanting, no contradictory evidence was observed during my researches. The aborigines cultivated extensively on some of the islands, a species of plant, on the bulbs of which they partly subsisted, and they even exchanged them with the people of the main land. I did not say that the design of the digging-stick was to open graves, as the handy Haliotis shell was better adapted to this purpose in the sandy ground of the islands in which the graves are located. The fact that some of the rings are of light weight is no argument against my position, as digging-sticks are used without weight, by the Australians of our day. There is hardly a class of relics that is not frequently represented by diminutive specimens, rougher and less symmetrical than the full-sized (they may have been playthings for children); but these should not deter the student from correctly naming the average sized objects." Mr. Bowers says, "Those of pyramidal form were doubtless used for spinning, while the others [simply a variety in form, but alike in perforation] were used in games." How were these used for games, and those for spinning? I have summed up the evidence for their use as weights to digging-sticks in a paper, entitled "Aboriginal

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Manufacture," now in the hands of the Curator of the Peabody Museum.

The second part of Anales del Museo Nacional de Mexico contains the following anthropological papers: Cuestion Historica, Sr. D. Jesús Sanchez; Dedicacion del templo major de México, Sr. D. Manuel Orozcoy Berra; Estudio comparativo entre el Sanscrito y el Naguatl, Sr. G. Mendoza, director del Museo; Idolo Azteca de tépo japones.

The Smithsonian Institution has long had the intention of publishing an exhaustive work upon North American archæology, accompanied by maps, exhibiting by signs and colors the site and character of all archæological remains. To this end a circular has been issued and the Institution calls upon all lovers of American antiquities to lend a helping hand, which the readers of the NATURALIST, doubtless, will not be backward in doing.

FOREIGN.—The following papers have come to our notice since our last issue: Gaul and its History under the Romans, by Professor Friedlander, in *Deutsche Rundschau*, for December; Mythology among the Hebrews, Ignaz Goldzieher, reviewed in *Nature*, January 3d; The Second Harvest in Olympia, Professor Ernst Curtius, *International Review*, February; Das Problem über den Ursprung der Sprache, O. Caspari, in *Ausland*, 1877, Nos. 47, 48, 49; Der Mensch, vormals und heute, Richard Oberländer, Otto Spämer, Leipsic, 1878; La Question de l' Homme Tertiaire, L'Abbé Bourgeois, Louvain, Peeters, 1877; Grammar and Dictionary of Samoan, Rev. G. Pratt, London, edited by S. J. Whitmee; *The China Review*, or Notes and Queries on the Far East, bi-monthly, Trübner & Co.; Transactions of the Philological Society of London, 1877–8–9, Part I, 800 pp.; Ueber die Methoden zur Ermittlung der topographischen Beziehungen zwischen Hirnoberfläche und Schädel, A. Ecker, in *Archiv für Anthropologie*, 1877, III.; Die Grosshirnwindungen des Menschen und deren Beziehungen zum Schädeldach, von Dr. I. Hefftler, id; zur Archäologie des Balticum und Russlands, von A. Grewinck, id; Les Allees Couvertes de la Provence, P. Cazalis de Fondouce, *Matériaux*, 10; Transactions of the Asiatic Society of Japan, V, Part I, October 1876–1877; Transactions of the New Zealand Institute, Index of Vols. I–VIII, by James Hector, Wellington; The Physical Basis of Mind, *Mind*, January; Fetichism in Animals, Geo. J. Romanes, *Nature;* "The Land of Cold, M. Nevirovich-Danchenko, St. Petersburg; Assyriology, *London Quarterly*, January; The Languages of India, Robert Cust, *Geographical Magazine*, January, finely illustrated; An Account of the Polynesian Race: its Origin and Migrations, and the Ancient History of the Hawaiians, Abraham Fornander, Vol. I, Trübner; The Dawn of History; An Introduction to Pre-historic Study, C. F. Keary, London, Mozley & Smith; Archæology in Italy, Felice Barnabei, *Academy*, January 12.—OTIS T. MASON, Washington, D. C.

GEOLOGY AND PALÆONTOLOGY.

A PROBLEMATICAL FOSSIL from the Cretaceous of Bohemia is described by Dr. Anton Fric in his volume on this formation in the Archiv der Naturw. Landesdurchforschung von Böhmen, under the name of *Lepidenteron longissimum*. It is quite abundant, and resembles a cast of a worm-boring, or of an elongate alimentary canal of a fish. It is covered with scales and bones belonging to different species of fishes, and Dr. Fric suggests that it is the cast of a tube of some worm, which covered its abode with those objects, as the larvæ of *Phryganeidæ* use mineral and vegetable fragments at the present time.

THE PLASTIC CLAYS OF NEW JERSEY receive a full exposition from Prof. Cook in the last report of the Geological Survey of that State (1878), so far at least as regards those of cretaceous age. He states the view of Lesquereux that they represent the Dakota epoch of the west, and offers some pertinent remarks as to their probable origin. He believes that they were derived from the decomposition of feldspars contained in the granite and gneiss of a former extension of the azoic beds now visible to the north-east and south-west in the high grounds of the cities of New York and Philadelphia. This exposure Prof. Cook believes to have formed a barrier to the eastward of the present beds of cretaceous age, and to have at times excluded the salt-water from the enclosed lagoon. This hypothesis was, we believe, first proposed by Prof. Cope in explanation of some characteristics of the cretaceous formations of New Jersey. Additional evidence in favor of the derivation of the material from the south-east is seen by Prof. Cook in the absence from the clays of all traces of the material of the Triassic formation which bounds it on the north-west at the present time.

PLIOCENE VERTEBRATA OF THE VAL D'ARNO.—Dr. C. I. Forsyth Major, in the Atti. Soc. Toscana d. Sc. Nat., describes two species of *Canis* from the upper val d'Arno and val d'Era, which he regards as new, and names *Canis etruscus* and *C. falconeri*. The former is as large as the wolf; the latter rather larger. Mr. Major gives the following list of species of the pliocene of the upper val d'Arno; *Macacus* 2 sp., *Felis* 3 sp., *Canis* 2 sp., *Ursus* 1 sp., *Mustela* sp., *Hyæna* 2 sp., *Machærodus* 3 sp., *Equus* 1 sp., *Hippopotamus* 1 sp., *Mastodon arvernensis*, *Elephas* 1 sp., *Rhinoceros* 1 sp., *Sus* 1 sp., *Bos* 1 sp., *Cervus* 4 sp., *Castor* 1 sp., *Hystrix* sp., *Lepus* sp.

SURFACE GEOLOGY OF BRITISH COLUMBIA.—We have received from Mr. G. M. Dawson of the Canadian Geological Survey, a letter upon this subject, calling our attention to what had been printed by himself on the Geology of Vancouver Island, of which we had not known when our article was published in the NATURALIST for November, 1877.

"I have just read your interesting notes on the glaciation of

the Pacific coast, in the November number of the AMERICAN NATURALIST. I traversed the same region on my way to Victoria last spring, and hope shortly to publish in the Canadian Naturalist a few memoranda made at the time. As you will see by the abstract of a paper of mine, read before the Geological Society last June (posted with this), I believe it can be shown that the glaciation of the south-eastern part of Vancouver Island was not accomplished by the glaciers of the interior of the island, as such, but by a great glacier sheet filling the Strait of Georgia, which though receiving tribute from the mountains, was fed chiefly by the accumulations on the coast range of the mainland, and perhaps through its gaps by ice from the central plateau of the country. I hope soon to be able to send to you a printed copy of the paper referred to, which will make the points on which this supposition is based, clear. The north to south glaciation of the interior of the province, mentioned in the abstract, I have been able to confirm during this season's exploration, in a number of additional localities, and have even found it furrowing the summit of an almost isolated mountain at an elevation of over 5000 feet.

"The original discovery of marine shells in the drift of Vancouver Island is due to Mr. H. Bauerman. You will find the matter mentioned in the Quart. Journ. Geol. Society, 1859, p. 198; also in Dr. Hector's Report of Explorations in the North-west; see also Mr. Dawson's article in the Canadian *Naturalist*: 'Note on some of the more recent changes in Level of the coast of British Columbia and adjacent Regions.'"

MICROSCOPY.[1]

NEW METHOD OF OPAQUE MOUNTING.—Mr. C. C. Merriman of Rochester, in a recent communication to the microscopical section of the Troy Scientific Association, describes the method of preparing his elegant preparations of foraminifera which have attracted unusual attention and admiration in the Postal Club, at the soirée of the Troy Association, and indeed wherever they have appeared. A cell is first made of a brass curtain ring slightly flattened by a hammer and suitably cemented to a slide. A cover glass, of size to match, is then varnished on one side with a thin solution of balsam, and upon this coating, when sufficiently hard, the shells are arranged in the usual manner; the whole group is then varnished over with successive coats of the balsam solution until completely imbedded in it; coats of asphalt varnish are then added until a perfect black-ground is obtained. The success of these procedures depends almost wholly upon using the solutions in a thin state, and allowing one to dry thoroughly before another is added. When all is dry and hard, the cover, with its objects mounted on it, is inverted on the cell

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

and attached by any strong varnish, and the joint finished off with white zinc cement. The objects appear with great distinctness, lying with their upper surfaces on a level and close to the cover glass, but looking as if they were at the bottom of a dark, deep cell. This method is also applicable to many of those objects which show well as opaque objects when immersed in balsam.

IMAGES IN THE EYES AFTER SUDDEN DEATH.—Mr. Henry C. Hyde, the newly elected president of the San Francisco Microscopical Society, in his opening address, gave a very interesting summary of the recent remarkable discoveries of Profs. Böll, of Rome, and Kühne, of Heidelberg, in the anatomy and physiology of the eye. He said that the popular notion that the *murderer's image* is found photographed as it were on the retina of his victim's eye may have some foundation in fact, viewed in the light of these recent discoveries, especially those of Dr. Kühne. Histologists have always considered the rods and cones of the retina, which are taken to be the terminal organs of the optic nerve, to be in a natural condition when under examination. Prof. Böll found, however, that when the animal, say a frog, is killed rapidly and the retina viewed as quickly as possible, it has peculiarities never before observed, and throwing new light on the physiology of vision.

Since the experiments of Dr. Kühne are more elaborate and extensive than those of Prof. Böll, a sketch of them will be most instructive. Prof. Boll found that the newly removed retina had a rosy purple tint, which was difficult to examine, because exposure to light changed it in ten seconds to a satiny lustre, and then after fifteen minutes of transparency to a turbid opacity. Dr. Kühne discovered that if kept in the dark, or in sodium (yellow) light, the delicate "vision purple" of the removed retina could be retained as long as wished, thus making a series of very original and incisive experiments possible. It is proved that the retina contains a substance which, under the influence of light, undergoes a chemical change varying in intensity with the intensity and character of the luminous rays. In the living retina there is some process which restores to this substance its responsiveness to light as fast as it loses it by the action of light—a continual recharging with powder, as it were, of the retinal batteries which the impact of light waves is continually firing whilst vision continues. But after death, or removal of the retina, the gunner—the faithful heart with its supply of nutrient blood—having ceased his work, the last charge is fired and the batteries stand emptied. So, the light waves remove the color from the isolated retina in a few moments, unless they be shut out by darkness, then the retina can be kept in its natural condition, purple colored, the batteries ready charged to signal to the brain

by their discharge the impact of the first light wave. Having thus the power of keeping retinæ just as they leave the eye, by immersing them in darkness, or yellow light, very much as the photographer takes his negative from the camera and preserves and finally *fixes* the image, working at it always by yellow gas-light, Kühne also preserved the images that were in the natural photographic plate, the retina of the natural camera, the eye, and actually *fixed* these images by soaking them in a solution of alum. Thus he would fix the head and one of the eye-balls of a living rabbit opposite a bright skylight, cover it with a black cloth for five minutes, then remove the cloth, exposing the eye a few minutes, immediately remove the eye, soak in alum, and, upon examining the retina, find a beautifully accurate image of the skylight, showing its separate parts, the boards, etc. Even the eye in a severed head gave these results. The images were generally of a rosy hue.

Now, while this proves that images of objects seen before death may be found on the retina after death, yet, since to make this possible, the eye and the object must be perfectly still for some minutes, and the light must be strong, it probably never has happened, and never will happen that the image of the murderer is found in the eye of his victim, murder being a deed of darkness, and a deed tending to anything but immovableness in those enacting it.

Annual Elections in Microscopical Societies.—The following officers of societies have been elected since those last published:

Jamestown Microscopical Club. Organized June, 1873. Meets first Thursday evening of each month. Dr. A. Waterhouse, president; Chas. E. Fuller, secretary and treasurer.

Louisville Microscopical Society. Founded January, 1874. Meets first and third Thursdays of each month at Louisville Library. Dr. J. B. Marvin, president; Dr. J. Sloan and Prof. W. F. Beach, vice-presidents; D. W. Lane, secretary; J. Williamson, corresponding secretary; A. L. McDonald, treasurer.

San Francisco Microscopical Society. Henry C. Hyde, president; C. Mason Kinne, vice-president; X. Y. Clark, recording secretary; C. W. Banks, corresponding secretary; J. A. Langstroth, treasurer.

Buffalo Microscopical Club. Dr. L. Howe, president; Jas. W. Ward, secretary; Henry Mills, D. S. Kellicott and Geo. E. Fell, advisory council.

Laboratory work at the seaside.—The third session of the Summer School of Biology will be opened at the Museum of the Peabody Academy of Science, Salem, Mass., beginning July 5th and continuing six weeks. Lectures will be given five days of each week, and the best of opportunities afforded for laboratory

work with the microscope. In addition to the regular instruction in zoölogy by Dr. A. S. Packard and Messrs. C. S. Minot, J. H. Emerton and J. S. Kingsley, a series of afternoon lectures on microscopy will be given by Rev. E. C. Bolles. Admission fee, $20.00; board, $5.00 to $7.00 per week.

Besides this tempting arrangement, a marine zoölogical laboratory will be opened June 1st, on the outer shore of Salem Neck, under the care of Messrs. Emerton and Minot, in a position most favorable for the study and collection of marine plants and animals. The cost will be $20.00 per month, and students can conveniently attend the Summer School of Biology at Salem.

SOIRÉES.—The annual meeting of the Buffalo Microscopical Club, at Goodrich Hall in that city, terminated in a soirée and exhibition of microscopic objects. A large variety of popular and interesting objects were shown under nearly twenty microscopes, to the universal gratification of the large audience. Dr. Geo. E. Blackham, of Dunkirk, and Chas. E. Fuller, of Jamestown, assisted the local members in the entertainment of the evening.

The microscopical section of the Troy Scientific Association and a large party of invited guests were entertained at the residence of the chairman of the section, Dr. R. H. Ward, on the occasion of the annual soirée on the evening of March 4th. The microscopes, over thirty in number and many of them first-class instruments, were arranged on tables in different parts of the house, and the objects were classified in a strictly natural manner, each table with its group of instruments being used to illustrate some one field in the study of nature. By substituting this plan for the want of method which is generally allowed to result from the caprice of individual exhibitors, and the use of a systematically arranged catalogue, and of cards stating the objects shown and the magnifying powers used, the exhibition was carried on promptly notwithstanding the large crowd in attendance. The soirée was the largest and most enthusiastic meeting ever held by the section.

EXCHANGES.—Wanted, some well-posted diatomist to give the correct names of diatoms (arranged) on a few slides in exchange for the slides. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

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SCIENTIFIC NEWS.

— A paper has been recently published in the *Penn Monthly Magazine* by William Blasius of Philadelphia, in which he criticizes the methods of meteorological investigation usually adopted. He, however, commends those employed by Prof. Loomis, of Yale College, but asserts that they have been mostly derived from his own previously issued publications.

— Recent arrivals at the Philadelphia Zoölogical Gardens, Feb. 10, 1878: 2 Chinese or knobbed geese (*Anser cygnoides*), presented; 2 common marmosets (*Hapale jacchus*), 1 black-eared marmoset (*Hapale penicillata*), presented; 2 barn owls (*Strix flammea*, var. *americana*) presented; 3 opossums (*Didelphys virginiana*), presented; 1 red-shouldered buzzard (*Buteo lineatus*), presented; 1 eland (*Oreas canna*) ♀, purchased; 1 siren (*Siren lacertina*), presented; 1 red-shouldered hawk (*Buteo lineatus*), presented; 1 bald eagle (*Haliaëtus leucocephalus*) presented; 2 rough-legged buzzards (*Archibuteo lagopus*), purchased; 3 white rabbits (*Lepus cuniculus*), presented; 4 hybrid fowls, presented; 8 dingos (*Canis dingo*), born in the Garden.—*Arthur E. Brown, Gard. Supt.*

— The Proceedings of the National Academy of Sciences, Vol. I, 1877, contains Selections from the Records of the Home Secretary, Prof. J. E. Hilgard, under whose direction this volume has been published. Unfortunately Congress has not yet authorized the publication of the papers and memoirs presented by the members at the semi-annual meetings of the Academy.

The Biographical Memoirs of the deceased members of the National Academy of Sciences has been published by the Home Secretary, and forms a volume of 343 pages. It contains obituary notices of fifteen deceased members.

— We have received, from Mr. Townend Glover, Manuscript Notes from my Journal, or Entomological Index to name, etc., in Agricultural Reports, with List of Vegetable and Animal Substances injured or destroyed by Insects, etc., Washington, 1877. This is a quarto work of 103 pages in the author's clear and legible handwriting transferred to and printed on stone. It forms a useful supplement to the laborious works of the author on the Diptera and Hemiptera, printed for private distribution.

— A new curriculum of education having been adopted by the board of control of public schools of Philadelphia, which includes a space in each of the divisions throughout the course, to be devoted to object study, the question of the introduction of primary instruction in the natural sciences is being agitated. At the last teachers' institute of the city, held in the Girls' Normal School, a lecture was delivered by Prof. Cope, in advocacy of this measure. In this lecture Prof. Cope explained that teaching in this department should never be without natural objects, models or charts. For general or comparative study, where the student should use a considerable number of objects, it was pointed out that petrology, mineralogy, botany, and entomology present the greatest facilities, since specimens can be obtained in these departments with the greatest ease. In the majority of departments of geology and biology it was maintained by the lecturer, that charts giving simple analyses of structure should be used, and it was recommended that these be of two kinds. Those of the first kind

were to stand in place of the text-book in other departments, to be of smaller size, and to be accompanied by pages of explanations, constituting an atlas to be studied by the scholar. The other kind should be of large size and be used in the school room like wall-maps without printed explanation. The exercises should be tests of proficiency of the student in the identification of parts in the specimens or the wall-maps, after study of the atlas or the object, under direction of the teacher. Instruction in classification following identifications of parts, were recommended to be conducted by the aid of simple analytical keys, either drawn by the teacher on the blackboard, or in chart form, like the diagrams of structure, suspended on the wall. The similarity between instruction in geology and structural biology, to geography was commented on, and systematic science was regarded as standing among the first of the methods of training of the human mind in all questions of practice or thought. In the dynamical sciences, or structure in motion, the use of text-books was regarded as necessary.

— The following circular has been issued by the Pennsylvania Board of Agriculture, and is signed by Thos. J. Edge, Secretary. As an effort to obtain reliable information on an obscure subject, by a goverment commission, it is worthy of general attention from those to whom it is addressed:

"Harrisburg, February 1, 1878. Dear Sir:—The report of this Board for your district has named you as a practical dairyman, who would be likely to take an interest in the advancement of our knowledge of dairy matters, and who would also be willing to answer any question which may be asked, with a view of obtaining such information. If our reporter is right in his surmise, and you are willing thus to assist me, you will please signify the same on the enclosed card; giving *full name and address, with number of cows in your dairy*, and return the card at your earliest convenience. This Department is aware that we have enough of theory, and are much in need of practical observation, and we think that by proper application of this kind of observation, you can enable us to render comparatively certain many items which are now in doubt.

"Of such subjects, we have selected the possibility of regulating the sex of calves as the first to claim your attention, and I would respectfully ask your careful and practical observation of the following theory, for one year, and would further ask that you report when you have any information to warrant you in so doing, giving the cases in which the theory has held good, as well as those in which it has failed. You can also confer a favor by directing the attention of your farm club or grange to the matter, and also interest any other dairyman in your neighborhood.

"It has been claimed by good authority, and the claim seems to be supported by proof, in some cases at least, that each alternate ovum will produce a male if impregnated at the proper

period: That is, if a cow has just produced a male calf, and is served at the next period of heat, a heifer will be the result; thus each ovum producing alternately male and female. If, as is often the case, your male is kept separate from the cows, you will have superior advantages for observation, and your results will prove of value in determining the question.

"Each one who will thus assist, and gives notice of his desire to do so by enclosed card, will receive a copy of the total result, and will also be entitled to the thanks of the Department."

— An account and figure of a two headed gopher snake (*Pityophis* species), by Mr. J. W. A. Wright, appears in the *Mining and Scientific Press*, San Francisco, February 16, 1878. A similar monstrosity in an eastern species, the common striped snake, we believe, was described by the late Professor Wyman, in the Proceedings of the Boston Society of Natural History for January 21, 1863 (vol. ix).

— The German botanist, Regel, has discovered, according to *Nature*, in the Himalayas a variety of wild onion, which he regards as the original source of our ordinary garden onion. It is called *Allium cepa sylvestre*.

— The well-known Danish conchologist, Dr. A. L. Mörch, died in January last at Nice. The eminent Swedish botanist, Prof. Elian Fries, died at Upsala, February 8, in his 84th year.

— Drs. W. Marshall and A. B. Meyer, have published a memoir, as one of a series of communications to the Zoölogical Museum, at Dresden, "On some new or little known sponges belonging to the Hexactinellidæ found in the Philippines." It seems but the other day since one could have numbered on the fingers of one hand all the known species of this family, so well known to many by that beautiful typical form, the Venus's flower-basket (*Euplectella*), and now the number of described species is very large. In 1872 one of the authors (Dr. Meyer) was staying at Cebú, one of the Philippine group, where *Euplectella aspergillum* is a regular article of trade, quoted at so much a dozen, and where it is not surprising that he should discover a number of other lovely forms in this memoir described and figured. Among the more interesting forms are the following: *Hyatocaulus simplex*, *Mylinsia zittelii*, and two species of *Aulodictyon*, all of those found being attached to the basal portion of *Euplectella*. *Semperella schultzei* is figured of a natural size from a specimen twenty-one inches in length, and figures of the spicules of the various new species are also given.—*Nature*.

— The interest in the reproduction of Batrachians is by no means yet exhausted, says *Nature*. A Spanish naturalist, Jimenez de la Espada, has recently discovered additional facts respecting *Rhinoderma darwinii* (of Chili), which was first made known by Mr. Darwin. He finds that the supposed viviparous birth of the young from the female is a very different phenomenon. It is the males

which are the nurses, and they have an extraordinary brood-sac, developed as a pouch from the throat, and extending over a great portion of the ventral surface of the animal. In this cavity a number of living tadpoles were found, in numbers of individuals, and the length of the tadpoles was about 14 mm. How these are first developed and nourished is not yet known. Dr. J. W. Spengel translates a portion of the Spanish paper in the current number of the *Zeitschrift für Wissenschaftliche Zoologie*, vol. xxix, part 4.

— We have received and are much pleased with the first two numbers of *The Young Scientist*, a popular Record of Scientific Experiments, Inventions and Progress. It is well adapted for boys, the articles being attractive and clearly written. It has our hearty sympathy and good wishes.

— MacMillan & Co., have in preparation the first part of a "Course of Instruction in Zoötomy," by Prof. Huxley, assisted by Mr. T. J. Parker. They are about to publish "A monograph on the development of Elasmobranch Fishes," by Mr. F. M. Balfour.

— During his recent five months' explorations in Costa Rica, Mr. A. Boucard collected about a thousand specimens representing 250 species of birds, some of great variety and two new to science (*Zonotrichia boucardi* and *Sapphironia boucardi* of Mulsant).

— We copy from Sir J. D. Hooker's address before the Royal Society, the following notice of the U. S. Geological Survey of the Territories, of which Professor Hayden has the charge:

Of the many surveys of the United States Territories undertaken, some by the central government, others by State governments, and still others by private enterprise, more or less aided by public funds, none has effected so much for science as that directed by Dr. Hayden. Its publications, distributed with great liberality, are in every scientific library, and its director is honored no less for the energy and zeal with which he has labored as a topographer and geologist, than for the enlightened spirit in which he has sought to render the resources of the survey available for the advancement of all branches of natural knowledge by every means in his power, and with admirable impartiality.

Having obtained an extended leave of absence from my official duties at the Royal Gardens, at the close of our last session, I accepted an invitation from Dr. Hayden to join his survey, and, in company with our foreign member, Professor Asa Gray, to visit, under his conduct, the Rocky Mountains of Colorado and Utah, with the object of contributing to the records of the survey a report on the botany of those States.

I have thus had some opportunity of learning for myself the extent and value of the operations of the survey, which are so interesting that I venture to think a brief sketch of its rise and progress and a few of its results may be acceptable to you.

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In 1872 the survey was further extended, and was organized into two corps, each provided with a topographer, geologist, mineralogist, meteorologist, and naturalist, and the States of Idaho and Montana were embraced in its operations; in 1873 it was pushed into Colorado, thence into Utah, and on its completion in 1876, an area of not less than 70,000 square miles, much of it exceedingly mountainous, had been included in the survey.

The literature of the survey, consisted, in 1876, of 41 volumes, classified as follows: 1, annual reports, with maps and sections; 2, bulletins for giving speedy publicity to new facts; 3, miscellaneous publications, comprising tables of elevations, catalogues of plants and animals, and meteorological data; 4, monographs on various branches of natural history, especially paleontology, copiously illustrated with admirable plates in quarto, among which are the works of Leidy, Lesquereux, Coues, C. Thomas, Cope, Parry, Meek, Packard, Allen, Hayden himself, and others, all of whom are well known on this side of the Atlantic; lastly, the number of photographs now exceed 4,000, and includes besides geological and geographical features of great interest, views of ancient architectural remains, and of 1,200 Indians belonging to seventy-four tribes.

In giving these particulars I speak from some personal knowledge. I wish that the same could be said of the local habitation of the survey and its museum, which I am assured contains a

very extensive and instructive collection; but these are at Washington, and my pressing duties here and at Kew prevented my visiting the federal Capital.

The most important scientific results hitherto derived from the labors of Dr. Hayden and his parties are unquestionably the geological; such as the delineation of the boundaries of the Cretaceous and Tertiary seas and lakes that occupied more than one basin of the mountain of Central North America, and the marvelous accumulation of fossil vertebrates that these ancient shores have yielded. Over an area of many hundred thousand square miles in North America there have been found, within the last very few years, beds of great extent and thickness, of all ages, from the Trias onwards, containing the well-preserved remains of so great a multitude of flying, creeping and walking things, referable to so many orders of plants and animals, and often of such gigantic proportions that the palæontologists of the states, with museums vastly larger than our own, are at a loss for space to exhibit them. So common indeed are some species, and so beautifully preserved, that I saw numbers of them, especially insects, plants and fishes, exposed for sale and eagerly purchased by travelers with confectionery and fruit, at the stalls of the railway station, from the eastern base of the Rocky mountains all the way to California.

An examination of some of these fossils has brought to light the important fact that in North America there is no recognized break between the Tertiary and Cretaceous beds. This is due to the interpolation of a vast lignitic series, the fossils of which furnish conflicting evidence. Concerning this series Dr. Hayden, who has traced it over many hundred miles, observes (Report of Geological Survey, 1874, p. 20), that the character of its palæontological as well as of its strictly geological results is such that whether the entire group be placed in the Lower Tertiary or Upper Cretaceous is unimportant, and that the testimony of the palæontologists will probably always be as conflicting as at present.

I must not end my notices of some of the labors of our scientific brethren in the United States without expressing my admiration of the spirit and the manner in which the Government and people have coöperated in making known the physical and biological features of their country, and my conviction that the results they have given to the world are, whether for magnitude or importance, greater of their kind than have been accomplished within the same time by any people or government in the older continents. How great would now be our knowledge of the climate and natural features of India and of our colonies had the excellent trigonometrical survey of the one and the territorial and geological surveys of the others been supplemented by reports such as those to which I have directed attention!

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, BIOLOGICAL AND MICROSCOPICAL SECTION, Philadelphia, January 21, 1878.— Dr. R. S. Kenderdine in the chair. Mr. Ryder related some observations which he had made on the residual image in the retina, as to the changes of color it undergoes, and as to the length of time it remains after the real image has ceased to excite the retinal cones and rods. The matter was discussed at length by Dr. Seiler, Messrs. Zentmayer, Perot and Ryder.

Mr. Potts then made an interesting communication on carnivorous plants. In the course of his remarks he gave a full description of the *Drosera*, *Dionæa* and *Nepenthes*. Of the latter he showed two preparations of the pitchers, one mounted flat in balsam, and the other in a deep cell filled with benzole, both stained with hæmatoxylin. These beautiful preparations showed the peculiar distribution of the spiral vessels and excreting as well as absorbing glands. Mr. Potts called particular attention to the fact that the spiral vessels in this plant consist of four fibres, and do not anastomose, even in the midrib of the leaf, but are collected in bundles and run alongside of each other. He also described the peculiar openings of ducts along the serrated and inverted margin of the pitcher.

Feb. 4, 1878.—At the stated meeting of the section, Mr. Jos. Zentmeyer, exhibited a cheap form of dissecting microscope, which he had designed at the instance of Prof. Rothrock, of the University of Pennsylvania, adapted to the wants of his botanical class. He set forth the advantages of the new instrument as combining steadiness, convenience of manipulation and smallness of cost, which latter is generally an important item with students of minute vegetable and animal anatomy.

Dr. McQuillen made some interesting experiments upon reflex nervous action as illustrating Pfluger's laws. Further remarks were made by Profs. Hunt, White, Houston and Dr. Kenderdine in relation to Dr. McQuillen's experiments.

Mr. Potts exhibited mounted fragmentary specimens of ants taken from the pitcher of Nepenthes, a carnivorous plant, native of Australia and the East Indies. The insects had been thoroughly digested, not a particle of soluble organic matter or protoplasm was left inside the external shell of chitin, which forms the covering of the creatures. The specimen was therefore a very instructive one, as illustrating how completely carnivorous these plants have become. The most interesting part of their structure is the presence of the honey-secreting glands on the outside which attract the ants, which, when they venture still further up the pitcher, finally are bold enough to crawl up into its mouth, never more to return, and to be drowned, digested and appropriated to nourish the structures of the invidious destroyer.

Glands of a very remarkable form are found in great numbers upon the inside of the pitcher, whose function it seems is to secrete the solvent or digestive fluid; others open in the inturned rim of the mouth, which are regarded by Dr. Hunt, their discoverer, as the only vegetable gland with a proper excretory duct.

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edited by H. Rink. The Island Tribe of Great Nicobar, by Fr. A. de Röepstorff.

THE GEOLOGICAL MAGAZINE.—January. Recent Progress in Palæontology, by A. Nicholson. American Surface Geology, III, by S. V. Wood.

February.—On the Preservation of Deposits under Till or Boulder Clay, by J. Geikie.

ZEITSCHRIFT FÜR WISSENSCHAFLICHE ZOOLOGIE.—November 30. Rhizopod-studies, by E. Buck. Anatomy of the star fishes, by H. Ludwig. On the nauplius of the shrimps (Peneus), by F. Müller. The organ of smell of female Heliconid butterflies, by F. Müller. On the Natural History of Cestodes, by H. A. Pagenstecker.

January 22.—Contributions to a knowledge of the Flagellata, by O. Bütschli. On the lungs of Birgus latro, by C. Semper. The organs of copulation of the sharks, etc., by K. R. Petri. The brain of the alligator, by Rabl Rückhard.

JENAISCHE ZEITSCHRIFT FÜR NATURWISSENSCHAFT, Marz 20, 1877. The Physemaria, Gastræades of the present time, supplement to the Gastræa theory, by E. Hæckel. On the pencils of hair, felt-spots, and similar structures on the wings of male butterflies, by Fritz Müller. Contribution to the developmental History of the Lepidoptera, by B. Hatschek.

June 15.—On the structure and development of Spirochona gemmipara (an Infusorian), by R. Hertwig. Embryology of the Decapods, by P. Mayer.

November 3.—On Leptodiscus medusoides, a new Flagellate allied to Noctiluca. Studies on the Rhizopods, by R. Hertwig. On the Nervous System and Sense-Organs of the Medusæ, by O. and R. Hertwig.

THE QUARTERLY JOURNAL OF CONCHOLOGY—Nov. 1877 and Feb. 1878. Remarks on the Geographical Distribution of Terrestrial Mollusca, by C. P. Gloyne.

CANADIAN ENTOMOLOGIST—January. Notes on Lycæna pseudargiolus and its Larval History, by W. H. Edwards.

CANADIAN NATURALIST, viii, No. 6—Dec. 29. Notes on a few Dykes cutting Laurentian Rocks, more especially with reference to their microscopic structure, by B. J. Harrington. Notes on the Surface Geology of New Hampshire, by Warren Upham. Lower Carboniferous Fishes of New Brunswick. Note on a Fossil Seal from the Leda Clay of the Ottawa Valley, by J. W. Dawson.